

Original Article

The factors influencing compliance in post-EVAR surveillance regarding the perspectives of practitioners and patients

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Abstract

Aim: Lifelong monitoring is essential to detect aorta-related complications. Yet, patient non-compliance with surveillance programs poses a significant obstacle. We explored reasons for adherence by engaging in clear, patient-centred communication and analyzed factors contributing to non-compliance.

Material and Methods: In 2019, our clinic conducted elective EVAR procedures on 50 patients. They were informed of annual surveillance, including hospital visits, starting with a first-month appointment post-discharge. Patients with no or only one follow-up were deemed non-compliant, while two to three follow-ups indicated moderate compliance, and four to seven follow-ups qualified as high compliance. We recorded each patient's age, education level and demographics. We retrospectively assessed the factors on their compliance level as our first outcome. The second was to explore whether the survey could enlighten any reasons from the patient's perspective.

Results: The average age of our cohort was 68.8 ± 8.45 years, with only three females. Non-attendance at follow-ups was observed in 8 patients (16%). Seventy percent (35 patients) complied with at least two appointments. Residing in the same city markedly increased compliance by 20 times ($p < 0.001$). Older age appeared to influence compliance positively, on the borderline significantly ($p = 0.057$). The primary motivation for attendance was adherence to doctor recommendations ($n = 14$), while the predominant reason for non-attendance was patients' feeling well ($n = 29$). Notably, patients with lower compliance than predicted more frequently cited COVID-19 as a deterrent ($p = 0.02$).

Conclusion: Residence within the same city positively influences follow-up compliance. The national databases might be helpful tools for enhancing the surveillance anywhere the patients live. The existing hypotheses by healthcare professionals about patient follow-up compliance are only partially corroborated. Incorporating the patient's perspective into these models may be helpful in comprehensively understanding the underlying factors.

Keywords: Post-endovascular aortic repair surveillance, follow-up, patient compliance

INTRODUCTION

The global increase in Endovascular Aortic Repair (EVAR) procedures has significantly heightened the importance of diligent post-EVAR surveillance. Occasionally, optimal sac remodelling is not attained post-EVAR, presenting a persistent risk of rupture [1]. Concentrating on minimizing rupture risks over the years can significantly decrease aneurysm-related mortality. Consequently, contemporary guidelines stipulate the necessity for lifelong monitoring and the employment of various algorithms to ensure

patient safety and improve long-term outcomes in post-EVAR patients [2]. Nevertheless, adherence to post-EVAR surveillance protocols remains suboptimal. Approximately half of the patients are lost to follow-up over the five years after the procedure [3]. This lack of compliance underscores a significant challenge in longitudinal patient management and highlights the need for improved strategies to ensure consistent monitoring and follow-up in this patient population. The implications of this trend are far-reaching, affecting both patient outcomes and the effectiveness of post-EVAR care protocols. Hence, optimizing

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surveillance programs and improving patient compliance are critical issues for individual centres.

The determinants of compliance and non-compliance with post-EVAR follow-up remain unclear. Global disruptions such as the COVID-19 pandemic, economic crises, or specific regional issues could significantly mitigate these essential follow-ups. Various demographic and socio-economic factors may influence adherence to medical advice, while limited access to healthcare facilities could hinder scheduled appointment attendance. In addition to patient-centric factors like age, cognitive abilities, and education level, positive interactions with healthcare providers may enhance follow-up compliance. If the model for predicting patient adherence is based on only the practitioner's perspective, the models may not fully encompass these diverse influences. Consequently, carefully investigating these underlying factors is crucial before proposing generalized solutions or interventions.

Our study aimed to elucidate the factors contributing to follow-up in post-EVAR surveillance. Our team crafted a questionnaire to assess reasons for patient compliance from the patient's viewpoint. Despite healthcare providers emphasizing adherence to the surveillance protocols, patient non-compliance is a problem in our country and others. To address this, we conducted a retrospective search on the compliance of the patients who underwent endovascular procedures from January 2019 to January 2020, with a minimum three-year follow-up.

MATERIAL AND METHODS

We performed elective EVAR for 55 patients from January 2019 to January 2020. Patients who underwent emergency procedures or had concurrent surgeries or interventions were excluded. Five patients who died due to cardiac complications (3 patients) and COVID-19 (2 patients) were excluded. The remaining 50 patients were warned to obey follow-up protocols before discharge, and an appointment was arranged for the controls following discharge. Before the procedure, this mandatory surveillance program was explained to patients that if the patient had experienced EVAR, he should have come to hospital controls at least annually. According to our surveillance program, participants should have six routine appointments (1st month, 6th month, 12th month, and then annually) with Colored Doppler Ultrasonography (CDUS) and/or Computed Tomographic Angiography (CTA).

Retrospectively, we assessed patient adherence to annual imaging follow-ups for EVAR, utilizing the national database, 'e-Nabiz', to verify if patients sought care at other medical centres. We employed a classification system to determine compliance levels: non-compliant (no or one follow-up), moderately compliant (two or three follow-ups), and highly compliant (four to seven follow-ups). Patient demographics, age, education, number of outpatient clinic visits, and frequency of Computed Tomography (CT) and Colored Doppler Ultrasonography (CDUS) were systematically recorded. Our first objective was to examine factors influencing

compliance levels. Second, we identified patients with better or worse compliance than anticipated and investigated their reasons for compliance or non-compliance by using a predictive model. The survey, designed by our cardio-endovascular surgery team regarding current literature and regional context, focused on understanding patient perspectives and factors affecting patient compliance (Figure 1).

Patient Adherence Questionnaire

Date:

The questions are designed to collect information on your follow-up adherence and explore why you have attended the appointments. Please click here to indicate your informed consent to participate in this study.

I approved ☐

Name: _____

Signature _____

1. When did you have your operation? Month Year

2. Where are you living currently? _____

3. Please record your educational degree: _____

4. How many health checks have you come to? The amount of

5. Which radiological imaging was used in your follow-up? How many imaging was used during your follow-up period?

RADIOLOGICAL IMAGING TEST & ACCOUNT OF

(Please write the number of imaging tests)

1. Computed Tomography Angiography:

2. Doppler Ultrasonography:

3. Computed Tomography:

6. Do you think "The computed tomography and by using contrast is harmful? "

Yes ☐ No ☐

7. Do you think the screening and surveillance program being important after EVAR operation?

Yes ☐ No ☐

8. Both before and after the operation, you were given suggestions and information about participating in health checkups. Do you remember that? Please mark Yes or No.

Yes ☐ No ☐

9. Have you ever gotten an appointment and attended any check-up after EVAR treatment? If the answer is yes, please notify your motivation for your attendance.

No ☐ Yes ☐ The reason was _____

10. Have you ever missed your any appointment?

Yes ☐ No ☐

11. If the answer is yes, please clarify your reasons of not keeping follow-up.

1. _____ 2. _____ 3. _____

Thank you for your time!

Figure 1. Crafted questionnaire to determine reasons for their attendance

The study investigates the hypothesis that, beyond determined factors by health care providers, patient-specific limitations may impact the compliance and follow-up attendance to surveillance.

Statistics: Statistical analyses were performed using SPSS for Windows version 20.0 software (SPSS Inc., Chicago, IL, USA). Continuous variables were expressed in mean ± standard deviation (SD), while categorical variables were expressed in number and frequency. Means were compared using the Student T-test, and categorical data were compared using the Fischer Exact and chi-square test, where appropriate. The participants' answers were recorded. The factors, including age, gender, educational status, and inhabitancy, were analyzed with a generalized linear model and ordinal logistic regression. Statistical significance was taken as p<0.05, and 95% confidence interval limits were given.

Ethical approval for this study was obtained from Hospital Clinical Research and Ethics Committee (15.12.2021/E1-21-2226).

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RESULT

Our study encompassed a cohort of 50 patients who underwent EVAR from January 2019 to January 2020, comprising three females and 47 males. The age distribution ranged from 55 to 90 years, with a mean of 68.8 years and a standard deviation of 8.45.

Chronic kidney disease was present in six patients. Notably, 28 patients were residents where the outpatient follow-ups were conducted. A substantial proportion, 42 patients, engaged in at least one follow-up, with eight having no follow-up. The follow-up attendance of the patients in the surveillance program was given (Table 1).

Table 1. Patient characteristics, follow-up imaging modalities, and post-EVAR surveillance		
Demographics	N OR mean	% OR SD
Gender	47 male vs 3 female	94 vs 6
Age	68.8	8.45
CKD	6	6
Patient status		
Educated	32 patients	64
Living in the same city	28	56
Informed for follow-up	50	100
Aware of information	40	80
Radiological imaging		
CTA	28	56
CDUS	39	78
CT	9	18
Attendance		
None	8	16
1	7	14
2	5	10
3	10	20
4	8	16
5	7	14
6	4	8
7	1	2
Post-EVAR surveillance		
Non-compliant	15 patients	30
Moderate compliant	15 patients	30
High-compliant	20 patients	40

CKD: chronic kidney disease, Educated: referred to as the patients being literate or not; All patients were informed, however, some were unaware or had forgotten the information. CTA: computed tomographic angiography, CDUS: color doppler ultrasonography, CT: non-contrast computed tomography

The surveillance imaging modalities were various for assessment: doppler ultrasonography (DUS) for 39 patients, computed tomography angiography (CTA) for 36 patients, and non-contrasted computed tomography imaging for nine patients. Within the subgroup subjected to DUS, the number of sessions per patient was as follows: 10 patients underwent DUS once, 13 patients twice, 11 patients three times, and five patients four times. Regarding the cohort that underwent CTA scans, 26 patients received the scan once, nine patients twice, and one patient three times.

Regarding our compliance classification, the cohort comprised 15 non-compliant, 15 moderately compliant, and 20 highly

compliant patients, indicating rates of 30% non-compliance and 40% high compliance. The analysis focused on demographics, residents in the same city (Residence in the city where the medical centre is), educational status, the impact of medical advice on follow-up adherence, and concerns regarding follow-up modalities like CTA. Residing in the same city was a critical factor for compliance ($p<0.001$, OR:20.1, CI 95%; 4.1-96.9). A trend of increased compliance with age was observed, although it lacked statistical significance ($p=0.057$). Similarly, factors such as gender, educational level, and the influence of medical advice showed positive correlations with adherence rates, but these did not achieve statistical significance (Table 2).

Table 2. Parameters on post-EVAR compliance

Parameters	B	Std. Error	95% wald confidence interval (CI)		Sig (p).	Exp (B)	95% wald confidence interval for exp (B)	
			Lower	Upper			Lower	Upper
Male	-.893	1.6274	-4.082	2.297	.583	.410	.017	9.945
Educated	.501	.9608	-1.382	2.384	.602	1.650	.251	10.848
Living in the same	3.004	.8009	1.434	4.574	.000	20.169	4.197	96.924
Age	.101	.0530	-.003	.205	.057	1.106	.997	1.227
Well-informed	1.513	1.0205	-.488	3.513	.138	4.538	.614	33.538

Educated: Referred to as the patient being literate or not; living in the same referred the patients who Residence in the same city where the EVAR procedure was performed in the medical centre; Well-informed referred the patients who informed with leaflets. (Logistic regression analysis was performed and statistical significance was determined as $p < 0.05$ with wald and corrected 95% CI.)

The medical professional-oriented model achieved a precision rate of 66% in accurately estimating compliance levels. Nonetheless, 16% of participants exhibited higher compliance than expected, whereas 18% demonstrated lower compliance levels than anticipated (Figure 2). Our investigation focused on understanding the disparities in follow-up compliance from the patient's perspective, specifically examining whether the reasons for adherence or non-adherence varied among patients with compliance rates that were either higher or lower than those predicted by our model. We elicited the rationale for attendance from 42 patients and the reasons for non-attendance from 36 individuals. The survey indicated compliance was primarily driven due to being symptomatic, as noted by 13 patients (30.9%). Fourteen patients (33.3%) attended their appointments

as a result of their own health conscious. Eleven (26.1%) were prescription renewals or health reports. Six patients (14.2%) cited doctor admonitions as motivation for their attendance. Conversely, the reasons for non-attendance were several. A majority, 29 patients, cited being well, so they did not attend their follow-ups. Transportation difficulties posed a significant barrier for 24 patients. COVID-19 caused 19 patients to miss their appointments. Economic constraints, such as travel costs, were reported by six patients as their reason. The survey revealed that COVID-19 as a causative factor for non-attendance was significantly higher within the subgroup with lower compliance than anticipated ($p=0.03$). The other reasons or beliefs did not differ in better or worse compliance than expected (Table 3).

		A TOTAL OF 50 PATIENTS WITH EVAR		
		15 NON-COMPLIANT	15 MODARATE COMPLIANT	20 HIGH-COMPLIANT
DOCTOR PERSPECTIVE	AGE	67.60 ± 5.28 (min:59, max:76)	67.67 ± 7.62 (min:56, max:82)	70.45 ± 10.8 (min:55, max:90)
	GENDER	1 female, the rest were male	All were male	2 female, the rest were male
	RESIDANCE	2p in Ankara vs 12p outside	7p in Ankara vs 8p outside	1p outside vs 19p in Ankara
	EDUCATION	8p educated vs 7p non	11p educated vs 4p non	13p educated vs 7p non
	ADMONISHED	8p admonished vs 7p non	13p admonished vs 2p non	19p admonished vs 1p non

**The independent factors account for 55% of the variation in the dependent variable. Nagelkerke: 0.55*

Factors on post-EVAR compliance were investigated. According to the model;

		Estimated Compliance			Total
		Non Compliant	Moderate Compliant	High Compliant	
Compliance of the Patients	Non Compliant	12	1	2	15
	Moderate Compliant	5	4	6	15
	High Compliant	1	2	17	20
Total		18	7	25	50

The compliance level was estimated correctly for 33 patients (%66) (referred as green). Eight patients had better compliance than expected (%16) (referred as blue). Nine patient had worse compliance than expected (%18)(referred as orange).

Figure 2. Investigating post-EVAR compliance by doctor perspective; a model was conducted with the factors that could affect the patient's compliance from the doctor's perspective; "Residence" referred the patients living in the same city; 'Admonished' referred the patients who received warnings from their healthcare providers about potential health consequences should they fail to comply with recommended attendance protocols. Subsequently, the accuracy of the model fitting was given

Table 3. The reasons for attendance and non-attendance towards patient perspective could affect the model predictions

The patients' answers to the questions (Q)		N	The number of patients with better compliance than model prediction	P	The number of patients with worse compliance than model prediction	P
Attendance (n=42) Excluded (n=8)	Answers to the Q9	42	n=8		n=9	
	Symptomatic	13	2	1	2	0.69
	Medication	11	3	0.41	4	0.2
	Admonishing	6	2	0.32	1	1
	Adherence	14	1	0.23	3	1
Non-attendance (n=36) Excluded (n=14)	Answers to the Q11	36	n=6		n=9	
	Far Away	24	5	0.64	7	0.68
	Economical	6	0	0.56	0	0.15
	Being Fine	29	6	0.14	8	0.65
	Covid-19	19	6	0.09	9	0.03
Belief N=50	Answers to the Q6,7	50	n=8		n=9	
	CTA harmful	20	5	0.24	3	0.72
	Screening Important	20	3	1	4	1

The answers were obtained from the survey and categorized. The reasons for their attendance (Question-9); "symptomatic" (being symptomatic), "prescription" (attendance due to medication or medical report), "admonishing" (warning about consequences), and "adherence" (having self-health-conscious). The reasons for non-attendance (The Question-11); "far away" (the centre is so far from their residence), "economic" (economic concerns), "being fine" (the patients being fine), "Covid-19" (due to restriction or fears due to the pandemic). Their belief having possible effects on compliance was obtained from the Questions and -7. (Fisher Exact x2 tests were performed, and statistical difference was given p<0.05)

DISCUSSION

The current guidelines have emphasized that lifelong surveillance is mandatory due to rupture risk [4]. Patient compliance with post-EVAR surveillance is poor, with great heterogeneity, and nearly 50% of patients have been lost to follow-up within five years [5,6]. There is also a great variability or heterogeneity in post-EVAR surveillance. Compliance with EVAR surveillance was variable across multiple centres, ranging from 7% to 88% [3]. Enhancing compliance should be a priority for health politics since early diagnosis of life-threatening endoleaks and sac enlargement could save the patients and improve the outcome of EVAR with timely reinterventions. Our current study showed that nearly 70% of our cohort, whom we named compliant, were under control. Living in the same city near the medical centre (p<0.01) and older age (p=0.05) were positive factors for compliance. Patient-reported reasons for attendance or non-attendance, excluding COVID-19 pandemics, showed no significant statistical variation between those with better or worse follow-up outcomes than anticipated. The COVID-19 pandemic, as a non-attendance reason from the patient's perspective, is significantly higher in patients with worsened compliance than expected. Therefore, incorporating patient-stated motivations into the predictive model would constitute a more precise methodology.

Grima et al. reported in EVAR-SCREEN that survival benefits for EVAR after three years appeared to be related to compliance

with surveillance [3]. The same group suggested in their meta-analysis that compliant patients may have an increased re-intervention rate but do not appear to have better survival rates than non-compliant patients [7]. This suggestion was supported by another meta-analysis of 22762 patients who underwent EVAR. It found that 43% were compliant with surveillance, and all had similar survival rates to those who were non-compliant [8]. Recent evidence has concluded that post-EVAR follow-ups may not be warranted. In our opinion, making such an inference may not be appropriate without investigating the reason for patients' compliance. We suggest systematically organizing follow-up management using algorithms based on temporal parameters and diagnostic tools tailored proportionally to the individual patient's assessed risk. Such an approach can enhance the follow-up adherence rate and make a difference.

We conducted a model with the factors that had a possible effect on compliance. Residence in the same city, age, personal education status, or informing the patient with leaflets could have an impact. We revealed that only living in the same city could have affected patient compliance. Even so, underlying reasons may vary with personal motives, which depend on the patient. For example, Tyagi et al. reported that patient satisfaction with their vascular surgeon and the medical centre's experience predicted compliance with post-EVAR surveillance regardless of postoperative complications [9]. The surveys can provide opportunities for practitioners to discover the factors affecting compliance. There could be some patient-based

factors, such as social, economic factors, education, and beliefs; some practitioner-related factors, such as positive relations, communication, and satisfaction with outpatient clinical visits; and healthcare-dependent problems, such as long waiting times, long distance to the place of residence, and difficulty getting prescriptions. All can influence the patient's compliance. Determining the possible reasons with surveys can provide better solutions to improving surveillance for all individual centres. The reasons for compliance and non-compliance may vary from patient to patient. Nine patients (18%) had follow-up controls in their city in another medical centre. The influence of the Covid-19 pandemic on patient follow-up adherence presents a topic of our research. This investigation should analyze the pandemic's multifaceted effects on healthcare access and patient attitudes towards their compliance. Studies conducted at the national level or even hospital-based studies can provide valuable insights into the factors contributing to decreased patient compliance and offer possible solutions. It is conceivable that the patient may not fully grasp the critical nature of the aneurysm, particularly in cases where the surgical intervention is minor and expeditious and is conducted on patients who are otherwise asymptomatic and devoid of complications. Notably, being symptomatic did not differ in attendance or non-attendance in better or worse compliance outcomes. On the other hand, being fine or having no symptoms can negatively affect patient compliance, but not significantly.

CTA remains the gold standard for EVAR follow-up; however, to reduce ionizing radiation exposure and contrast, CDUS may be a powerful diagnostic tool, as reported in the literature [2,10]. Also, having no risk of nephrotoxicity or repeated radiation doses, CDUS gives sufficient results for following up an EVAR patient with a Type 1 or 3 endoleak and maximum diameter in high correlation with CTA [10]. Twelve patients (40%) had a belief that CTA was harmful. Nevertheless, concerns regarding contrast and radiation appear to have a minor impact on patient attitudes towards follow-up. In our centre, both follow-up modalities are used with patient-physician consensus, and this algorithm can improve compliance. For better understanding, additional research in this area could be imperative.

Our country and patient profile are primarily compatible with the paternalistic model, in which the healthcare providers control the final decision. Previously, we reported that the information given to patients was limited to or as much as the other persons' (patient) understanding. The patients in our country obey what the doctor says in over 90% of treatment choices [11]. However, it differs for the post-EVAR surveillance. To enhance compliance with post-EVAR, we suggest some pivotal strategies. First, enhanced patient education with supplemental technologies (leaflets, interactive media, audio tapes, etc.) can strengthen the patient-practitioner interaction and can aid to improve the collaboration of low-educated and aged patients. Particularly

mitigating the challenges for patients from distant locations is crucial. Incorporating patient perspectives in compliance-enhancing programs may elucidate the effectiveness. Second, individualized follow-up program can aid to ensure regular health monitoring, facilitated by a clear understanding of the healthcare provider responsible, thus promoting patient compliance. As the custom-made treatment modality should be appropriate, the custom-made follow-up protocol should be provided by considering patients' properties and priorities. Third, establishing patient identity cards may reinforce the compliance by improving accessibility of medical histories, treatment plans with digital tools for reminders. Finally, a multidisciplinary approach involving a comprehensive team of healthcare professionals to offer tailored support and care, encouraging adherence to post-EVAR protocols and educational content is recommended.

Limitations

This study is limited by its small patient cohort and the exclusive focus on patients undergoing EVAR procedures, without comparative analysis to other treatment modalities. Our survey had limited questions, and there were limited factors from the practitioner's perspective. The patients had individual concerns and motivations for their compliance. Thus, there could be some trouble in categorization and standardization. For a better understanding, more studies with large series are needed.

CONCLUSION

Post-EVAR surveillance is a mandatory approach for better outcomes. Individualized follow-up algorithms, rather than a globalized approach, may enhance patient compliance. Efficient utilization of national medical databases could enable localized follow-up, reducing economic burdens and preventing the overloading of central medical facilities. In case of complications, patients could return to the hospital where the initial procedure was conducted. This system would rely on personalized communication and tailored scheduling for necessary scans.

Ethics Committee Approval: Ethical approval for this study was obtained from Hospital Clinical Research and Ethics Committee (15.12.2021/E1-21-2226).

Patient Consent for Publication: All participants involved in this study provided informed consent, acknowledging their voluntary participation and understanding of the study's objectives, procedures, and potential risks.

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