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Role of PTA and stenting in treatment of arteriovenous access dysfunction

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ABSTRACT

Aim: The aim of the study was to evaluate the results of endovascular treatment of arteriovenous fistula dysfunction at the Hospital of Lithuanian University of Health Sciences (LUHS) Kaunas Clinics.

Methods: Data of 125 patients, who underwent endovascular treatment of arteriovenous fistula dysfunction at the Hospital of Lithuanian University of Health Sciences (LUHS) Kaunas Clinics between 1st January, 2016 and 31st December, 2018 were analyzed.

Results: The study population consisted from 80 male and 45 female. The average age of the participants was $61,73 \pm 14,86$ years. 36,1% patient had AVF stenosis, 87,2% of them had just one stenosis site and 63,9% patient had occlusion. The most frequent localization of the occlusion or stenosis was at the site of AVF anastomosis – 68%.

Conclusions: 1. AVF occlusion was more frequent than stenosis. 2. Mostly AVF stenosis or occlusion were usually on one site. 3. Most often AVF stenosis or occlusion was found on the site of AVF anastomosis and rarely on the other localization.

Keywords: arteriovenous fistula, arteriovenous access, endovascular treatment, percutaneous transluminal angioplasty, stent.

1. Introduction

Arteriovenous fistula (AVF) is formed surgically for patients who need permanent hemodialysis. Over time AVF can become occluded or stenotic, what causes its failure. The meaning of this term differs in literature. Mostly it describes anatomical changes that cause difficulty in performing qualitative hemodialysis (1). Arteriovenous access stenosis or occlusion has meaningful negative effect on quality of hemodialysis. To prevent this, The National Kidney Foundation Kidney Disease Outcomes Quality Initiative Practice Guidelines on Vascular Access recommend that “all dialysis facilities have a program in place to provide regular assessment of the AV access and hemodialysis adequacy. The goal of this program is to prospectively detect the presence of AV access dysfunction” (2 – 3). Unfortunately, sometimes it is hard to predict early stages AVF disfunction at the time of inspection, but once it is diagnosed it must be treated. Nowadays various correction methods can be used: percutaneous transluminal angioplasty (PTA), surgical treatment, endovascular stent or stent-graft placement (4). The first choice for AVF disfunction diagnostic and treatment is endovascular. Stenotic lesions are commonly treated with PTA, PTA and stenting or stent-graft placement. Still, PTA is the gold standard treatment method because it leaves nothing behind. Unless it is not effective, then the stents can be used. In case of AVF occlusion whether to treat endovascular or surgically is still not very clear.

2. Aim

The aim of the study is to evaluate the results of endovascular treatment of arteriovenous fistula stenosis or occlusion at the Hospital of Lithuanian University of Health Sciences (LUHS) Kaunas Clinics.

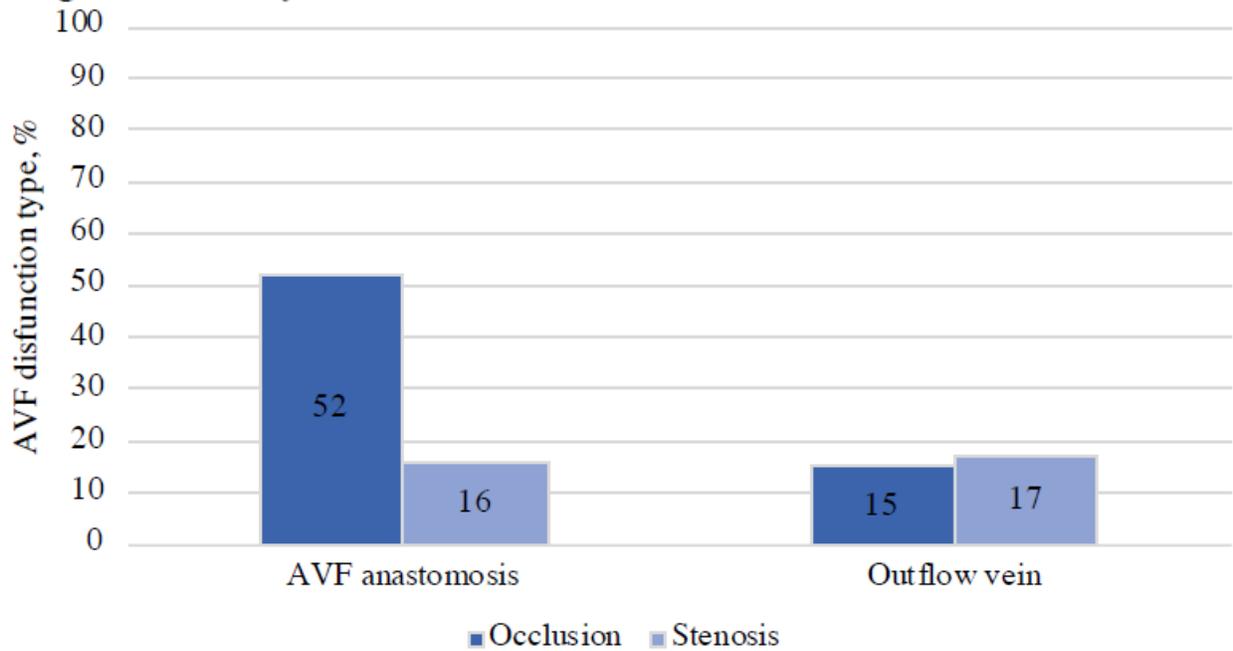
3. Methods

This research was approved by Lithuanian University of Health Sciences Bioethics Centre. Retrospective analysis was done. Analysis was performed from visual diagnostic database and treatment procedure protocols. This study included 125 patients treated and examined in the Hospital of LUHS Kaunas Clinics between 1st January, 2016 and 31st December, 2018. Cases were evaluated in terms of gender, age, occlusion or stenosis localization of the AVF, changes before and after treatment, treatment method. To compare results, we used „Microsoft Office Excel 2013“and IBM SPSS Statistics 25.0 software package. Statistical significance is $p < 0,05$.

4. Results

Of 125 patients there were 80 male and 45 female. The mean age of the participants was $61,73 \pm 14,86$ years ($60,51 \pm 15,09$ in male group and $63,74 \pm 14,1$ in female group). There was no statistically significant difference between male and female groups in comparison with age ($p=0,49$). Totally 125 procedures were performed. 33 procedures were radiological diagnostic examinations and rest 92 procedures were diagnostic procedures with endovascular treatment. The localization of AVF varied: 63,6% of patients had lower arm AVF, 36,4% - upper arm AVF. In total, 36,1% patient had AVF stenosis (of those: 87,2% had one and 12,8% had two or more stenosis) and 63,9% patient had occlusion. After evaluation it was found no statistical significance between lesion quantity ($p=0,184$). The most frequent localization of the occlusion or stenosis was at the site of AVF anastomosis – 68% (of those: 52% occlusion and 16% stenosis), while in the outflow veins – 32% (of those: 15% occlusion and 17% stenosis), but the statistical significance of treatment results wasn't found ($p=0,09$) between those groups (Figure 1).

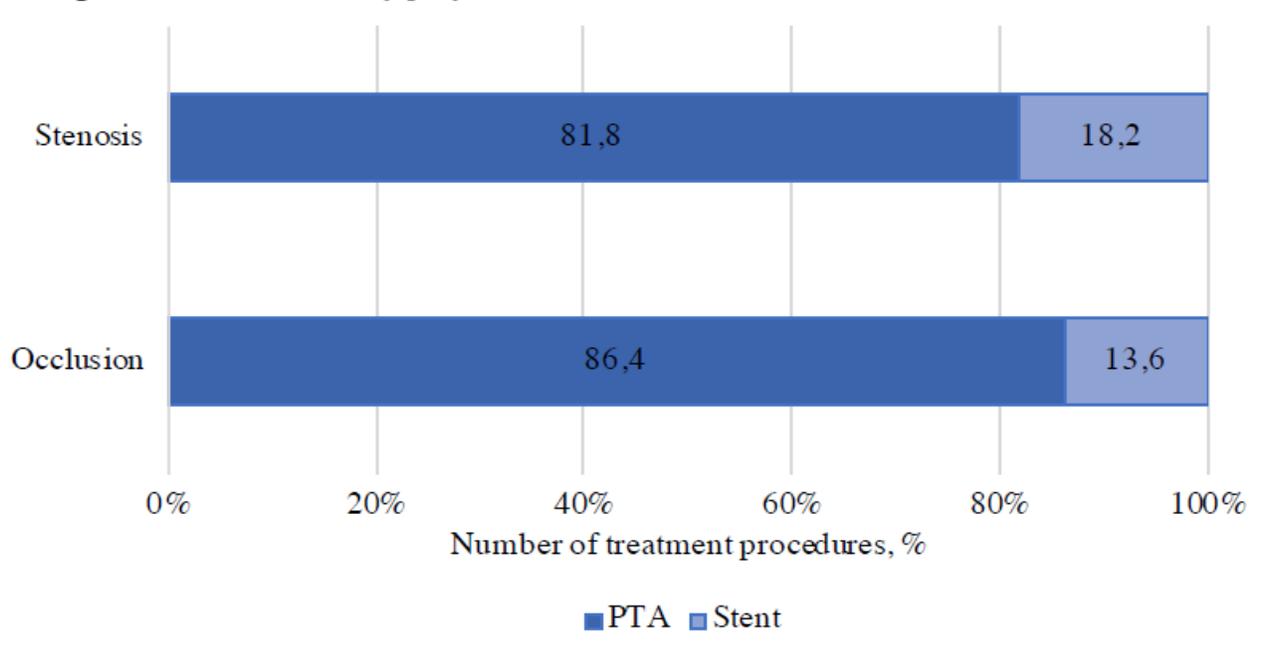
Figure 1. AVF disfunction site



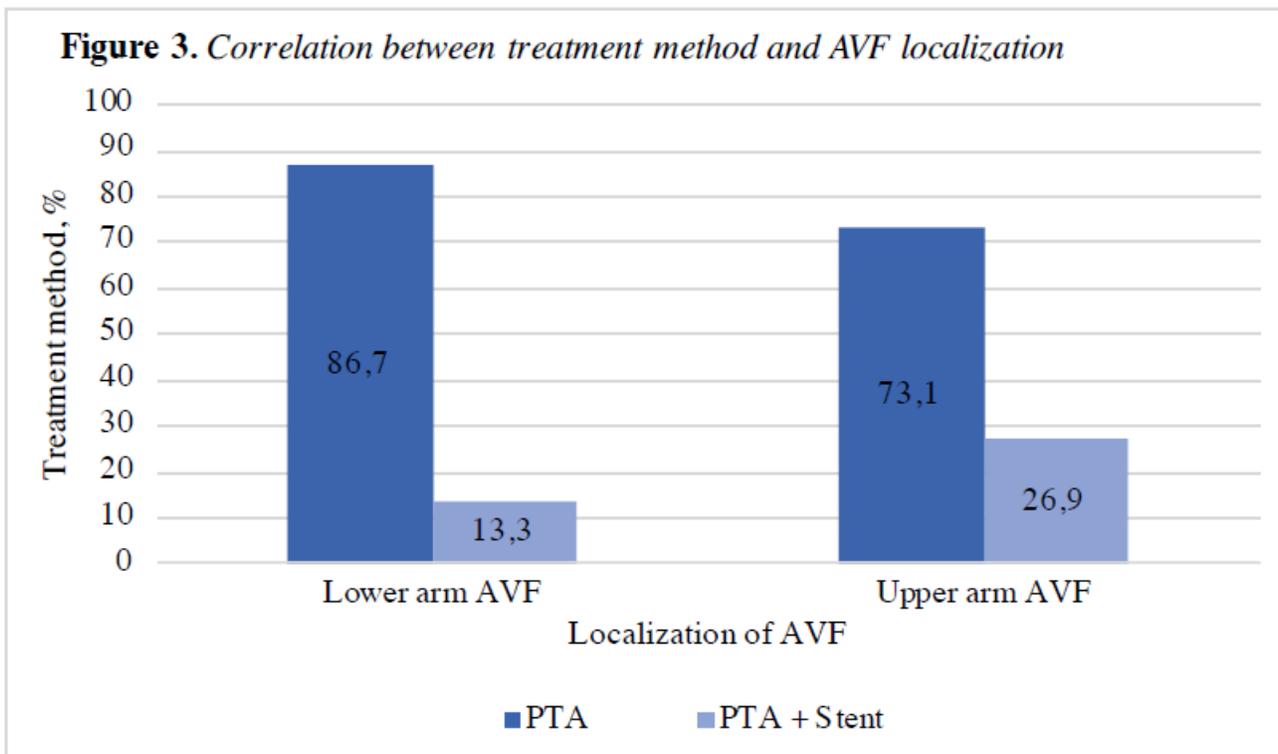
81,8% patient with stenosis were treated with PTA and 18,2% were stented. Patients with occlusion mostly were treated with PTA – 86,4%, while stented – 13,6% (Figure 2). There was found no statistically significant difference in

treatment success between stenosis and occlusion groups (p=0,051).

Figure 2. Distribution of performed treatment



In comparison, although PTA was the most common treatment method for upper and lower arm AVF, stent-graft placement was more frequently required for upper arm AVF (26,9%), than for the lower arm AVF (13,3%) (Figure 3). Even so, there was no statistical significance between treatment method and AVF localization (p=0,153).



Puncture sites during treatment were: radial artery – 58,7%, brachial artery – 19,56%, other – 21,74%. 10 treated patients’ results (10,87%) were not evaluated due to lack of information. For 9 patients (10,97%) treatment of stenosis or occlusion was not effective. Overall 73 patients had successful procedure. For 7 of these patients were achieved 100% successful recanalization with 0% residual stenosis. Successful treatment showed better results for women 96,88% compared to 84% treatment success in male group. There was no statistical significance between treatment success and gender group (p=0,069).

5. Discussion

Based on previous foreign research, stenosis or occlusion of the AVF is the most common chronic complication, causing it’s dysfunction (6). In our study, we decided to look through the results of revascularization and its’ success. Our research consisted of 125 patients, who had arteriovenous fistula stenosis or occlusion. Age of patients ranged from 27 to 88 years. The average age of the population was $61,73 \pm 14,86$ years. To our knowledge in the majority of studies the average age was quite similar (5, 7 – 8) . Previous researches showed, that male gender is more likely to have arteriovenous access stenosis or occlusion (5, 8). Relatively, we obtained similar results: study population consisted of

80 male and 45 female. Sedat Belli et al. in a study, conducted in Turkey, estimated that ordinary patients had brachial – cephalic fistula (9). However, our survey showed that radial - cephalic fistula is more common in LUHS Kaunas Clinics as in the Umraniye Training and Research Hospital (10). Nevertheless, our study showed that in Kaunas Clinics, as in the whole Europe, lower arm fistula is more common compared to the United States, where upper arm fistula is more often (11). According to our findings it became evident, that the most common localization of AVF failure was at the site of anastomosis. Meanwhile, other authors suggest, that most common localization of stenosis is in the outflow draining vein (6). In our hospital PTA is the first choice treatment method for AVF stenosis (3). Endovascular stent placement was needed only for 15,85% patient, although Mokdong Hospital researchers used stent even less frequently (5). Also, the difference may be achieved because of quite aggressive tactics of LUHS Kaunas Clinics endovascular specialists in case where success is not likely to achieve. During the study, we found that surgical treatment was recommended only for 8,8% patient. However, the practice of other countries shows that PTA is only a temporary solution of the AVF stenosis and occlusion, because revascularization surgery shows better results in AVF survival time (12). In LUHS Kaunas Clinics overall treatment success was achieved for 89,02% patients (96,88% in female and 84% in male group). M.Han et al. research shows quite similar results: technical success was 95,7% and clinical success – 86,5% (13). In comparison, in Jan H.M. Tordoir et al. Review of Evidence clinical success rates from 43% to 100% (14). All in all, our study has drawbacks due to its small sample size, but the initial results are similar to those of other foreign studies. Therefore, new researches about new therapies,

reduction of arteriovenous access dysfunction and new AVF creation methods are underway (15 – 17).

6. Conclusions

1. AVF occlusion was more frequent than stenosis.
2. Mostly AVF stenosis or occlusion had one lesion site.
3. Most often AVF stenosis or occlusion was found on the site of AVF anastomosis and rarely on the other localization.

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