

# Comparison of the results of Teflon felt and Dacron strip usage in Stanford type A dissection

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## ABSTRACT

**Objectives:** In patients who undergo surgery for aortic dissection, the anastomotic leakage and the bleeding in these regions affect surgical success and mortality rate significantly. Various surgical materials are used for this purpose. We examined the results obtained from patients in whom Teflon felt strip or Dacron strip was used for creating a more secure anastomotic suture line.

**Methods:** Twenty-eight patients who underwent surgery for ascending aortic dissection between 2013 and 2017 were examined retrospectively. Teflon felt strip or Dacron strip was used to create a more secure anastomotic suture line and to reduce bleeding in these patients. The patients were divided into the Teflon and Dacron groups according to the materials used. The amount of drainage, the amount of tissue adhesive used, the number of red blood cell (RBC) transfusions, and the morbidity and mortality rates were mainly compared between the two groups.

**Results:** While Teflon felt strip was used in 13 (46%) patients, Dacron strip was used in 15 (53%) patients. The mean amount of drainage in the first 24 hours postoperatively was  $596.15 \pm 165.15$  ml in the Teflon group and  $546.67 \pm 217.5$  ml in the Dacron group. There was no statistically significant difference between the two groups in terms of mean amount of drainage ( $p = 0.509$ ). Similarly, the mean number of RBC transfusions was  $2.54 \pm 0.51$  units in the Teflon group and  $2.33 \pm 0.81$  units in the Dacron group. There was no statistically significant difference between the two groups in terms of mean number of RBC transfusions ( $p = 0.416$ ). Although the mean amount of tissue adhesive used was relatively higher in the Dacron group, there was no statistically significant difference between the two groups in terms of mean amount of tissue adhesive used ( $p = 0.761$ ). The total mortality rate was 28% (8 patients). There was no statistically significant difference between the two groups in terms of mortality rate ( $p = 0.281$ ).

**Conclusion:** We concluded that the results obtained from the Teflon and Dacron groups were not significantly superior to each other. We think that Dacron strip may be used as an alternative to Teflon felt strip, which is used routinely in the surgical treatment of aortic dissection.

**Keywords:** Aortic dissection, Teflon felt strip, Dacron strip

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**A**ortic dissection is a rare but fatal disease. Early diagnosis and treatment of the disease is very important. If acute aortic dissection is left untreated, the mortality rate increases by approximately 1% per hour



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for the first 48 hours. 70% of patients die within the first week [1]. The Stanford classification divides aortic dissections into 2 types, type A and type B. Type A involves the ascending aorta. Type B does not involve the ascending aorta [2]. The primary goal of urgent surgical intervention in the treatment of Stanford type A ascending aortic dissection is to prevent aortic rupture, to treat aortic valve insufficiency, and to protect life by directing blood flow to dissected branch vessels [3]. Optimal treatment of type A acute aortic dissection is still a difficult challenge for cardiovascular surgeons. Despite all improvements, the mortality rate in conventional surgery of aortic dissection ranges from 10% to 27%. Today, open surgery continues its importance for treatment with acceptable results [4].

In the surgical treatment of aortic dissection, the Dacron graft interposition and the sandwich technique at the anastomotic line are today used in many patients. In the English literature, it is seen that Teflon®-felt strips and biological glues are usually used in the Sandwich technique for providing hemostasis and for creating a more tightly braided suture line [5, 6]. In the surgical treatment of ascending aortic dissection in our clinic, Teflon®-felt strip and Dacron graft strip were used as a surgical material in order to create a more secure anastomotic suture line and to contribute hemostasis in the anastomotic line. The patients grouped according to these two different materials were compared in terms of mortality and morbidity rates. Their results were evaluated.

## METHODS

Twenty-eight patients who underwent surgery for Stanford type A ascending aortic dissection between January 2013 and December 2017 were included in the study. The study was performed retrospectively using hospital records. Demographic data and risk factors of the patients were recorded. Teflon felt strip or Dacron graft strip was used for creating a more tightly braided suture line in the patients. The patients were divided into the Teflon and Dacron groups according to the materials used.

**Group 1 (Teflon):** Teflon®-felt strip was used at the proximal or distal suture line of the aortic graft in tube graft replacement of the ascending aorta.

**Group 2 (Dacron):** The same procedures were

performed with Dacron strip instead of Teflon® felt strip. Dacron strip was obtained from the abundant parts of the graft that we used for replacement of the ascending aorta.

All patients were primarily subjected to a detailed physical examination. Their risk factors were recorded. Before the surgery, the diagnosis was confirmed by computed tomography (CT) and transthoracic echocardiography. The Stanford classification was used to classify aortic dissections. The duration and type of surgery, the amount of drainage, the number of RBC transfusions, the amount of tissue adhesive used, the revision rate, and the hospital and intensive care unit length of stay were recorded for the patients. Postoperative complications such as stroke, multiple organ failure (MOF), and renal dysfunction and mortality rates were statistically compared between the two groups. This study was approved by the Local Ethics Committee.

## Surgical Technique

The patients were operated under general anesthesia. All patients underwent a standard median sternotomy and total cardiopulmonary bypass (CPB). Hypothermic antegrade perfusion was performed through right axillary artery cannulation with PTFE side-graft. In distal organ malperfusion, double arterial perfusion was provided with direct femoral artery cannulation in addition to axillary artery cannulation. Antegrade perfusion was established at a rate of 8–10 mL/kg/minute. Venous cannulation was performed through the right atrium. Operations were performed with moderate degree hypothermia of 24–28°C. In all patients, cardiac arrest was firstly provided with crystalloid cardioplegia. Isothermic hyperkalemic blood cardioplegia was used during the maintenance period. In the surgery, the areas where intimal tears occurred in the ascending aorta were firstly removed by resection. The dissected aortic layers were glued using fibrin tissue adhesive [Tissell® (Eczacıbaşı-BAXTER)]. Teflon® felt strip or Dacron graft strip was used for creating a more tightly braided suture line in the patients. The anastomotic suture line was supported with these materials. Aortic valve pathologies were repaired by methods such as valvuloplasty or the Bentall procedure. A Dacron tube graft of appropriate size was used for replacement of the ascending aorta. After the surgery, in the patients

in whom right axillary artery cannulation with PTFE side-graft was performed, the side graft was connected directly and was sutured on itself with polypropylene. In the patients in whom direct femoral artery cannulation was performed, the arteriotomy was closed primarily after the cannula was withdrawn.

### Follow up

The patients were followed up by CT and echocardiography in the postoperative period. Patient follow-ups were conducted through outpatient clinic visits and via telephone.

### Statistical Analysis

Statistical analysis data were analyzed with the Statistical Package for the Social Sciences (IBM SPSS Statistic Inc. version 21.0, Chicago, IL, USA). Continuous and ordinal variables were expressed as mean  $\pm$  standard deviation and nominal variables were expressed as frequency and percentage. Shapiro-Wilk tests of normality were used to identify distribution of variables. Student's t test was used to compare two groups for continuous variables with normal distribution. Chi Square test was used to compare two groups for nominal variables. Mann-Whitney U test was used to compare two groups for continuous variables without normal distribution. For all tests, a *p* value of  $< 0.05$  was considered statistically significant.

## RESULTS

A total of 28 patients were included in the study.

There were 13 (46%) patients in the Teflon group and 15 (53%) patients in the Dacron group. The demographic data and risk factors of the patients were evaluated according to the groups. There were 11 (84.6%) male patients in the Teflon group and 13 (86.7%) male patients in the Dacron group. The mean age was  $54.15 \pm 6.89$  years in the Teflon group and  $54.0 \pm 11.6$  years in the Dacron group. There was no statistically significant difference between the two groups in demographic data and risk factors (Table 1).

The intraoperative data of the patients were recorded (Table 2). Eight patients in both groups underwent isolated replacement of the ascending aorta. The Bentall procedure was applied in 4 (26.7%) patients in the Dacron group but not in the Teflon group. 5 (38.5%) patients in the Teflon group and 3 (20%) patients in the Dacron group underwent ascending aortic replacement plus aortic valvuloplasty. There was no statistically significant difference between the two groups (*p* = 0.281). Ten (76.9%) patients in the Teflon group and 14 (93.3%) patients in the Dacron group underwent axillary artery cannulation. Three (23.1%) patients in the Teflon group and 1 (6.7%) patient in the Dacron group underwent direct femoral artery cannulation in addition to axillary artery cannulation. There was no statistically significant difference between the two groups in terms of arterial cannulation site (*p* = 0.216).

Four patients in both groups underwent total circulatory arrest (TCA). The mean duration of TCA was  $5.77 \pm 10.97$  min in the Teflon group and  $3.53 \pm 8.11$  min in the Dacron group. There was no statistically significant difference between the two groups in terms of mean duration of TCA (*p* = 0.751).

**Table 1.** Demographic features of the patients

	Teflon group (n = 13)	Dacron group (n = 15)	<i>p</i> value
Age (years)	$54.15 \pm 6.89$	$54.0 \pm 11.6$	0.967 <sup>#</sup>
Male gender, n (%)	11 (84.6)	13 (86.7)	0.877 <sup>*</sup>
Hypertension, n (%)	12 (92.3)	13 (86.7)	0.630 <sup>*</sup>
Diabetes mellitus, n (%)	5 (38.5)	5 (33.3)	0.778 <sup>*</sup>
CAD, n (%)	-	2 (13.3)	0.172 <sup>*</sup>
CVD, n (%)	2 (15.4)	-	0.115 <sup>*</sup>
Smoke, n (%)	8 (61.5)	13 (86.7)	0.126 <sup>*</sup>

CVD = Cerebrovascular disease, CAD= Coronary artery disease. \* Pearson Chi- Square, <sup>#</sup> Student's t test

**Table 2.** Operative variables

	Teflon group (n = 13)	Dacron group (n = 15)	p value
Ascendan aortic replacement	8 (61.53%)	8 (53.3%)	-
Benthal procedure,	-	4 (26.7%)	<b>0.044*</b>
Ascendan aortic replacement + aortic valvuloplasty	5 (38.5%)	3 (20%)	0.281*
Arterial cannulation			0.216*
Axillary	10 (76.9%)	14 (93.3%)	
Axillary + Femoral	3 (23.1%)	1 (6.7%)	
Biological Glue	2.15 ± 0.37	2.20 ± 0.41	0.761 <sup>a</sup>
TCA	4 (30.7%)	4 (26.7%)	0.811*
CPB time, minutes	138.62 ± 14.75	148.13 ± 18.07	0.143 <sup>#</sup>
X-clamp time	58.85 ± 9.49	61.67 ± 11.09	0.480 <sup>#</sup>
TCA time	5.77 ± 10.97	3.53 ± 8.11	0.751 <sup>a</sup>

CVD = Cerebrovascular disease, CAD = Coronary artery disease, TCA = Total circulatuar arrest, \*Pearson Chi-Suquare, <sup>#</sup> Student's t test, <sup>a</sup>Mann-Whitney test

The mean duration of X-clamp was  $58.85 \pm 9.49$  min in the Teflon group and  $61.67 \pm 11.09$  min in the Dacron group. The mean total duration of CPB was  $138.62 \pm 14.75$  min in the Teflon group and  $148.13 \pm 18.07$  min in the Dacron group. There was no statistically significant difference between the two groups in terms of mean duration of X-clamp and mean total duration of CPB ( $p = 0.480$ ,  $p = 0.143$ ).

The postoperative data of the patients were recorded (Table 3). In the postoperative period, atrial fibrillation was observed in 6 (46.2%) patients in the Teflon group and in 1 (6.7%) patient in the Dacron group. Renal dysfunction was observed in 3 patients in both groups.

There was no statistically significant difference between the two groups in terms of atrial fibrillation and renal dysfunction ( $p = 0.055$ ,  $p = 0.843$ ). In the Teflon group, 3 (23.07%) patients had a stroke and 4 (30.76%) patients had MOF. Stroke and MOF were not observed in the Dacron group. The Teflon group had worse results for stroke and MOF. There was a statistically significant difference between the two groups in terms of stroke and MOF ( $p = 0.049$ ,  $p = 0.020$ ). In the postoperative period, low cardiac output was observed in 1 patient in the Teflon group and in 3 patients in the Dacron group. There was no statistically significant difference between the two groups.

The mean amount of drainage in the first 24 hours postoperatively was  $596.15 \pm 165.15$  ml in the Teflon group and  $546.67 \pm 217.5$  ml in the Dacron group. The mean number of RBC transfusions was  $2.54 \pm 0.51$  units in the Teflon group and  $2.33 \pm 0.81$  units in the Dacron group. There was no statistically significant difference between the two groups in terms of mean amount of drainage and mean number of RBC transfusions ( $p = 0.509$ ,  $p = 0.416$ ). The mean amount of tissue adhesive used was  $2.15 \pm 0.37$  in the Teflon group and  $2.20 \pm 0.4$  in the Dacron group. Although the mean amount of tissue adhesive used was relatively higher in the Dacron group, there was no statistically significant difference between the two groups in terms of mean amount of tissue adhesive used ( $p = 0.761$ ).

Sternal dehiscence and mediastinitis were observed in the early postoperative period in 1 patient in the Dacron group. This patient underwent revision. The mean intensive care unit (ICU) length of stay (hours) was  $100.31 \pm 71.21$  hours in the Teflon group and  $57.47 \pm 38.1$  hours in the Dacron group. The mean hospital length of stay (days) was  $9 \pm 4.76$  days in the Teflon group and  $7.93 \pm 5.03$  days in the Dacron group. There was no statistically significant difference between the two groups in terms of mean hospital length of stay ( $p = 0.571$ ). However, there was a

statistically significant difference between the two groups in terms of mean ICU length of stay ( $p = 0.048$ ). The total mortality rate was 28%. A total of 8 patients including 5 patients in the Teflon group and 3 patients in the Dacron group died. Cause of death was MOF and low cardiac output. There was no significant difference between the two groups in terms of mortality rate ( $p = 0.281$ ).

## DISCUSSION

There are many factors such as heredity, degeneration, atherosclerosis, inflammation, trauma, and toxicity in etiology of aortic dissection. Because of all these reasons weakening the aortic wall, especially the lamina media is exposed to extreme wall stress. As a result, aortic dilatation and aneurysmal formation cause aortic dissection or rupture [7].

The Stanford classification, which is based on involvement of the ascending aorta (type A and type B), is the most frequently used classification today. In patients with type A aortic dissection, severe catastrophic outcomes occur due to progression of rupture or dissection [2, 16].

The main purpose in the surgical treatment of aortic dissection is to remove the torn segments and to maintain vessel continuity by performing replacement with prosthetic vascular graft. For this purpose, it is very important to ensure vessel integrity by gluing the separated aortic layers with various biological glues. Today, the sandwich technique with Teflon felt strip or its modified forms are applied in aortic and prosthetic graft anastomoses in the surgical treatment of ascending aortic dissection. In our study, it was seen that Teflon felt strip and biologic glue were a common denominator for the anastomotic line [6-9].

In a study that evaluated the results of the surgical treatment of aortic dissection, it was observed that the dissected aorta was glued with biological glues in analogy to the literature. Subsequently, it was reported that the dissected aorta was approximated by the sandwich technique using internal and external Teflon felt strips or PTFE strips. However, Teflon felt strip or PTFE strip used to support aortic suture lines were not compared in this study [10].

Our basic principles in the surgical treatment of our patients are the replacement of ruptured ascending

aorta with prosthetic tube graft and the appropriate aortic root surgery in presence of the aortic root pathology. There were a few reasons why we used Dacron strip instead of the commonly accepted Teflon® felt strip in order to create a more secure anastomotic suture line. Firstly, it does not bring extra cost to the patient. Secondly, the Dacron graft has blood sealing properties. Finally, it provides a better anastomotic integrity because the material has a ring shape.

Major complications seen after the surgical replacement of ascending aortic dissection are bleeding or infection requiring reoperation, RD, permanent or transient neurological dysfunction, and MOF. All of these reasons lead to an increase in early and late mortality rates in patients [11].

Neurological events seen after the surgical replacement of ascending aortic dissection are a very important cause of morbidity affecting the life of the patient. Many methods have been tried to reduce these neurological events. The main methods such as retrograde cerebral perfusion under deep hypothermia, direct right axillary artery cannulation or right axillary artery side-graft cannulation, and antegrade cerebral perfusion under moderate hypothermia have been used [12]. All of these have advantages and disadvantages to each other [13]. However, although short periods of deep hypothermic circulatory arrest (30-40 min) do not make a significant difference in terms of neurological complications and mortality outcomes when compared with other cerebral protection methods [14]. Antegrade cerebral perfusion (ACP) has been reported to allow a more comfortable and secure anastomosis, especially in complex distal reconstructions. Many studies have reported that moderate hypothermia and persistent ACP are effective in protecting against neurological events [10, 11, 14, 15].

When the axillary artery was intact clinically, perfusion was routinely maintained through right axillary artery cannulation with PTFE side-graft. Perfusion was additionally supported by direct femoral artery cannulation if distal organ perfusion was insufficient. After the surgery, the side graft was cut near the anastomotic region and was sutured on itself. Thus, upper limb ischemia was prevented to occur because the axillary artery was not clamped. Moreover, it was aimed to prevent possible arterial

stenosis that may occur after direct axillary artery injury or cannula withdrawal.

In the literature, Sabik *et al.* [16] compared direct cannulation and side-graft cannulation. They found that complications related to side-graft cannulation were less frequently seen. Axillary artery injury and upper limb ischemia due to direct cannulation were more frequently seen[16]. We used PTFE side-graft for axillary artery cannulation in all our patients. Axillary artery injury or upper limb ischemia due to axillary artery side-graft cannulation was not observed in any patient.

The bleeding from especially aorta-graft and graft-to-graft anastomoses in aortic surgery is a very important factor that prolongs the duration of operation, requires additional blood transfusions, and increases risk of patient mortality [17].

Several methods have been described to stop bleeding in the surgical treatment of aortic dissection. These are anastomosis techniques to reinforce a suture line, glues for anastomosis or wrapping methods. A new method used for reducing bleeding in the anastomotic line is the Dacron graft intussusception technique described by Pinheiro *et al.* [18]. The common goal of all these techniques is to create a more secure anastomosis and to reduce surgical bleeding [17, 18]. In a case-series study of Pinheiro BB *et al.* [18], it was found that the mean amount of postoperative bleeding was 654 ml and that the revision rate due to bleeding was 4.1%.

In a case-series study of Emreçan *et al.* [10] in which the sandwich technique was performed using internal and external Teflon® felt strips or PTFE strips for creating a more secure anastomotic suture line, it was found that the mean amount of drainage was 1485 ml and that the revision rate due to bleeding was about 13%.

In our study, the mean amount of drainage in the first 24 hours postoperatively was 596 ml in the Teflon group and 546 ml in the Dacron group. Revision due to bleeding was not observed in both groups. Although the amount of drainage was relatively higher in the Teflon group, there was no statistically significant difference between the two groups in terms of amount of drainage and revision rate. The amount of drainage in both groups was similar to or less than the literature[10, 11, 14-19].

We compared whether there was any difference in

mean number of RBC transfusions between the two groups. The mean number of RBC transfusions was similar in both groups. There was no statistically significant difference between the two groups in terms of mean number of RBC transfusions ( $p = 0.416$ ). Although the mean amount of tissue adhesive used was relatively higher in the Dacron group, there was no statistically significant difference between the two groups in terms of mean amount of tissue adhesive used ( $p = 0.761$ ).

In a surgical series of Rylski *et al.* [3] involving 197 patients with type A aortic dissection, it was observed in two patient groups that the mortality rate was between 10% and 29%, the revision rate due to bleeding was between 7% and 14%, and the stroke rate was between 5% and 9%. The duration of X-clamp was between 97-134 min. Another large series study on the surgical treatment of type A aortic dissection belongs to Caus *et al.* [5]. In their case-series involving 83 patients, it was determined that the operative mortality rate was 37%, the postoperative stroke rate was 22%, the incidence of renal failure was 26%, and the bleeding rate was 7%. In addition, the mean hospital length of stay was found to be 15 days [5].

The postoperative complications in our patients were atrial fibrillation, RD, stroke, MOF, and revision due to infection. From among these complications, MOF (30%) and stroke (23%) were statistically significantly higher in the Teflon group than in the Dacron group ( $p = 0.020$ ,  $p = 0.049$ ). The mean intensive care unit (ICU) length of stay was statistically significantly lower in the Dacron group than in the Teflon group ( $p = 0.048$ ). A total of 8 patients including 5 (38%) patients in the Teflon group and 3 (20%) patients in the Dacron group died. However, there was no significant difference between the two groups in terms of mortality rate.

The patients were similar in terms of age, gender, and preoperative risk factors. When the intraoperative data were evaluated, the mean duration of X-clamp and the mean total duration of CPB were shorter in the Teflon group. However, there was no statistically significant difference between the two groups in terms of mean duration of X-clamp and mean total duration of CPB.

When both groups were evaluated according to the literature, the Dacron group had better results in terms

of complications such as mortality rate, amount of drainage, stroke, and MOF compared to other relevant studies. When compared with similar literature, the Teflon group had similar mortality rate, shorter hospital length of stay, and similar or slightly higher stroke and MOF rates. When compared with the literature, the operative time was shorter in both groups [3-5].

When the patient groups were generally evaluated, the Dacron group had lower stroke and MOF rates but longer operative time. Moreover, although not statistically significant, the revision rate due to infection was higher. In the Teflon group, although not statistically significant, the operative time was shorter, the hospital length of stay was longer, and the amount of drainage was higher. We cannot conclude that the two groups could be superior to each other. Before this study was performed, our most important consideration was whether there would be a difference in amount of drainage and revision rate between the two groups. However, there was also no clear superiority in this regard between the two groups according to our results.

## CONCLUSION

As a result of this study in which the results obtained from the patients undergoing surgery for aortic dissection were evaluated, we concluded that the Teflon and Dacron groups were not definitively superior to each other. However, complications of PTFE side-graft used for axillary artery cannulation were not observed in both groups. Therefore, we recommend that PTFE side-graft is used for axillary artery cannulation. There was no statistically significant difference between the groups in terms of amount of drainage, revision rate due to bleeding, and number of RBC transfusions. For these reasons, we think that Dacron strip which does not bring extra cost may be used as an alternative to the commonly accepted Teflon felt strip in order to create a more secure anastomotic suture line.

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