



Use of Fascia Lata Autograft for Augmentation of Bladder in Rabbits*

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Summary: In the present study; experimental defects were created in the rabbits at the urinary bladder and the repair of the defects with autogenous Fascia latae (FL) graft was provided. The aim was to evaluate whether the grafted urinary bladder capacity reached to the normal urinary bladder capacity. A total of 32, healthy male adult New Zealand rabbits were used in this study. The rabbits were randomly divided into four equal groups, i.e. group I, II, III and IV (control) according to the duration of euthanasia. Bladder capacities of the rabbits were measured preoperatively. Experimentally 2x2 cm defects were induced in the urinary bladder of the rabbits and repaired with autogenous FL graft in the first three groups. The rabbits in the control group underwent no surgical application. Postoperative bladder capacities of rabbits in the groups were measured at the end of 4th (group I), 8th (group II) and 12th (group III and IV), weeks before being euthanized. The urinary bladder capacities of control group were compared with those of the rabbits in the other groups. As a result, it was concluded that the autogenous Fascia latae graft might be used successfully in the urinary bladder with decreased capacity.

Key words: Augmentation, bladder, fascia latae, graft

Tavşanlarda İdrar Kesesi Ogmentasyonunda Otojen Fasya Lata Greftinin Kullanımı

Özet: Sunulan çalışmada; tavşanların idrar kesesinde deneysel defektler oluşturularak otojen fasya lata grefti ile defektlerin onarımı sağlanmış ve greft uygulanan idrar kesesi kapasitelerinin normal idrar kesesi kapasitesine ulaşip ulaşmadığının değerlendirilmesi amaçlanmıştır. Çalışma kapsamında, toplam 32 adet erişkin, erkek, sağlıklı Yeni Zellanda tavşanı kullanıldı. Çalışma materyalini oluşturan tavşanlar rastgele, eşit sayıda hayvan içeren dört gruba ayrıldı. Tavşanların operasyon öncesi idrar kesesi hacimleri ölçüldü. Grupları oluşturan tavşanların idrar keselerinde deneysel olarak 2x2 cm boyutunda defektler oluşturuldu ve bu defektler yine aynı tavşandan elde edilen 2x2 cm boyutunda otojen fasya lata dokusu ile onarıldı. Grup I'i oluşturan tavşanlar postoperatif 4. hafta sonunda, grup II'yi oluşturan tavşanlar postoperatif 8. hafta sonunda, grup III'ü oluşturan tavşanlar postoperatif 12. hafta sonunda idrar kesesi hacimleri ölçüldü ve ötenazi edildi. Kontrol grubunu oluşturan tavşanların idrar keselerine herhangi bir işlem uygulanmadan ötenazi edildi ve idrar kesesi kapasiteleri grup I, II ve III'de bulunan tavşanlardan elde edilen sonuçlar ile karşılaştırıldı. Sonuç olarak azalan idrar kesesi kapasitesinin eski kapasitesine ulaştırılmasında otojen fasya lata greftinin kullanılabilirliği kanaatine varıldı.

Anahtar kelimeler: Fasya lata, greft, idrar kesesi, ogmentasyon

Introduction

Inflammation that causes scar tissue formation and contraction, sclerosis and spastic neuropathy decrease urinary bladder capacity (9). Low capacity of urinary bladder results in increased frequency of urination. Urinary bladder at low pressure loses storage function and patients face a need for urination at short intervals (e.g.15-30 minutes). Anticholinergic drugs and expansion programs are applied in the medical treatment. Augmentation cystoplasty is referred to in cases where medical treatment is ineffective or due to structural disorders of the urinary

bladder (9).

Augmentation cystoplasty is a commonly used for surgical procedure in order to increasing urinary bladder capacity for the reduction of high intra bladder pressure in patients with low urinary bladder capacity and for protection of the upper urinary tract (12). In the augmentation of the urinary bladder, the small and large bowel segments are widely used in different configurations (21).

As an alternative to augmentation cystoplasty, intravesical pressure-reducing autoaugmentation may be performed. Various materials such as autogenous dura, pericardium, collagen and preserved intestinal submucosa and various methods including vesicomyotomy, vesicomyectomy, seromuscular entereostoplasty were applied for autoaugmentation. However, the

Geliş Tarihi/Submission Date : 09.01.2018

Kabul Tarihi/Accepted Date : 20.02.2018

* This study was supported by Erciyes University Scientific Research Projects Unit. Project number TDK-2016-6356. This study is summarized in the doctoral thesis.

ideal graft material to be used in urinary bladder augmentation has not yet been identified (18).

Fascia latae is used as graft materials in many different organs and tissues because of their strong and flexible content, low, immunologic and inflammatory effects, non-toxic effects, low cost, more resistance bacterial contaminations and easy to obtain. With regard to the urinary system, FL grafts have been successfully used in the closure of urethral defects (4,20), in urethral fistulas (5,11), in the treatment of urinary incontinence (10).

In the present study; the experimental defects were created in rabbit urinary bladders and repair of the defects with autogenous FL graft was provided. The aim of this study was to evaluate whether the grafted urinary bladder capacity reached to the normal urinary bladder capacity.

Materials and Methods

Animals

A total of 32 New Zeland male rabbits, aging between 10-12 months and weighing 2.089 ± 0.52 kg were included in this study. Prior to the study the rabbits were subjected to the thorough clinical examinations and found to be healthy.

Groups

Thirty two adult healthy New Zeland rabbits were randomly allocated into four different groups of eight animals called groups I, II, III (experimental) and IV (control). The autogenous FL grafts were applied to the defects on the urinary bladders of the rabbits in the experimental groups. All rabbits in group I, group II and group III were euthanized at the end of the 4th, 8th and 12th week, respectively. No surgical procedure was applied to control group rabbits and were euthanized at the end of 12th week. Urinary bladder augmentation test results of the rabbits in the control group were compared with that of the experimental groups.

Surgical Procedure

The right leg was routinely shaved and aseptic preparation performed from the coxo-femoral joint level to the tarsal joint for operation. Fascia latae graft measuring 2x2 cm was bluntly separated and harvested with surgical scissors (Figure 1).

After obtaining the FL graft, each rabbit was positioned in dorsal recumbency, midline laparotomy was made and the bladder exposed.



Figure 1. Removal of a 2x2 cm FL graft

Preoperative Augmentation Test

In order to determine the preoperative capacity of the urinary bladder, firstly the urinary bladder was evacuated and then the physiological saline solution was injected via urethral catheter at a rate of 5 mm/min. The amount to injection into the urinary bladder was measured when the piston forced during the injection of the physiological saline solution (Figure 2).



Figure 2. Injection of physiological saline solution into urinary bladder

After the measurement of the preoperative urinary bladder capacity, the defect was created in the most nonvascular area in corpus region of urinary bladder. A simple continuous suture pattern with a 4-0 Polydioxanone was applied to the FL to cover the defected area. The urethral catheter was applied to the bladder and 0.9% saline solution was administered to check for any leakage (Figure 3). After making sure that there was no leakage, the abdominal wall was routinely closed, and the operation was completed.



Figure 3. Control of leakage after application of a FL graft

Postoperative Care

Immediately prior to the operation and during the postoperative five days, animals were treated with ceftriaxone at a dose of 100 mg/kg IM for infection prophylaxis. Postoperative three days butorphanol was injected at a dosage 0.3 mg/kg subcutan (Sc) for analgesia.

Postoperative Augmentation Test

Rabbits completed the follow-up period were anesthetized. Median laparotomy was performed, and urinary bladder taken out of the abdomen. Firstly, a urethral catheter was inserted and the urine drained. Then, the physiological saline solution injection into the urinary bladder made end the postoperative urinary bladder capacity was measured (Figure 4).



Figure 4. Measurement of urinary bladder capacity before euthanasia

Euthanasia

At the end of the study, rabbits were euthanased with Na-pentobarbital at an intravenous (IV) dose of 100 mg/kg.

Statistical Analysis

The data was evaluated in IBM SPSS Statistics 22.0 statistical package program. The descriptive statistics were given as the number of units

(n), mean \pm standard error of mean ($\bar{x} \pm SEM$). Cross-group comparisons were made by One-Way ANOVA on normal dividing variables. In each group, the inter-time comparison was done with Paired Sample T-Test in case of normal dispersion of differences. A value of $P < 0.05$ was considered statistically significant.

Results

No complications were encountered during operation or anesthesia. At the midline laparotomy, it was observed that the FL graft applied to the defect site completely fused with the urinary bladder and was not macroscopically distinguishable from the urinary bladder. The comparison of the preoperative urinary bladder capacity with postoperative urinary bladder volume is given in Table 1. There was no statistically significant difference between the mean pre and postoperative urinary bladder volume for groups ($P > 0.05$).

In addition, the mean urinary bladder volume obtained before euthanasia in group I, II and III were compared with that of control group. The comparison of the mean data of urinary bladder capacities between groups is given in Table 2. In the comparison of the results of augmentation test between groups, the lowest value (95 ± 4.11 ml) was measured in group I and the highest value (119.37 ± 10.32 ml) in group III. The value obtained from the control group was recorded as 111.87 ± 4.99 ml. There was no statistically significant difference between the groups ($P > 0.05$).

Discussion and Conclusion

In this study, we performed augmentation of the urinary bladder using FL autografts and tried to evaluate. FL graft and urinary bladder compatibility, preoperative and postoperative capacity of urinary bladder, early and late postoperative findings were evaluated.

The augmentation cystoplasty is performed to increase the capacity of the urinary bladder and thus to improve the quality of life (13). In our study, urinary bladder was assessed by an augmentation test postoperatively. Fascia tissue

Table 1. Comparison of preoperative bladder capacities with postoperative values for groups

	n	Preoperative urinary bladder capacity (ml) $\bar{x} \pm SEM$	Postoperative urinary bladder capacity (ml) $\bar{x} \pm SEM$	p
Group I	8	101.87 \pm 4.42	95 \pm 4.11	0.270
Group II	8	113.75 \pm 6.52	111.87 \pm 4.99	0.504
Group III	8	106.87 \pm 9.58	119.37 \pm 10.32	0.158

Table 2. Comparison of augmentation test results between groups

	n	Postoperative urinary bladder capacity (ml) $\bar{x} \pm SEM$	p
Group I	8	95 \pm 4.11	0.095
Group II	8	111.87 \pm 4.99	
Group III	8	119.37 \pm 10.32	
Control	8	111.25 \pm 5.23	

composed entirely of collagenous tissue is not as flexible as urinary bladder wall. Norlen et al. (15) reported that the collagen tissue is stiffer than the smooth muscle of the urinary bladder. Therefore, the urinary bladder is not as flexible as healthy one when FL graft is applied.

In this study; we did not observe significant difference between preoperative and postoperative mean urinary bladder capacities. There was a slight decrease for mean postoperative urinary bladder capacities in group I (95 \pm 4.11 ml) compared to preoperative mean urinary bladder capacities (101.87 \pm 4.42 ml). In contrast to group I, the urinary bladder reached its former capacity in group II. In group III, the postoperative mean urinary bladder capacity increased above the preoperative measured capacity. The possible reason for the low postoperative urinary bladder capacity in group I might be due to the high collagen content of the graft as reported (15). However, the adaptation and compliance of the FL to the urinary bladder capacities appear to increase with time when the data of group II and group III having a longer postoperative period were considered.

Celayir et al. (6) removed 65% of the bladder tissue in group I and group II. The bladder augmentation was carried out by a full-thickness

Musculus rectus abdominis flap in group I. Moreover, they closed the bladder remnant routinely without any graft application in group II. The preoperative and postoperative urinary bladder capacity at the end of the 4th week were compared and postoperative urinary bladder capacity found to be decreased significantly in both groups. Human amniotic membran graft was applied to experimentally induced a 4x4 cm urinary bladder defects in dogs and the animal monitored for six weeks (22). At the end of the 6th week the urinary bladder capacity was not be able to reach its former capacity. Contrast to those studies, in our study, there was no statistically significant difference between preoperative and postoperative urinary bladder capacity for all groups.

Graft materials obtained from the gastrointestinal system are accepted as the gold standard today despite complications (3,16,17). It has been reported that grafts of intestinal segments have many complications such as chronic bacteriuria, stone formation, calcium-phosphate metabolism disturbance, growth retardation in bones, gastrointestinal motility disorders, mucus secretion, and fluid-electrolyte balance (1,8,16,17). In our study autogenous FL graft was used in augmentation of urinary bladder.

No postoperative complications were encountered.

Autogenous FL graft not is cost effective, harvested easily and at sufficient amounts with minor operation site disturbance and functional defect at the donor site, and also no sign of immunological reaction and tissue rejection at recipient site. In view of these properties of the FL graft (2,7,14) we think that it is a suitable graft material that can be used to provide the urinary bladder to its normal capacity.

As a result, it has been concluded that FL graft material can be used safely in increasing low urinary bladder capacity.

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