

SURGICAL USE OF FASCIA LATA GRAFTS AS BLADDER WALL SUBSTITUTES AFTER PARTIAL CYSTECTOMY IN DOGS

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ABSTRACT

The current study aimed to evaluate the effectiveness of fascia lata for grafting of the urinary bladder. Clinical, ultrasonographic and radiographic evaluations were performed. The study was carried out on ten healthy mongrel dogs of both sexes. They were divided into two equal groups. The animals in the control group were subjected to cystectomies, followed by suturing of the remaining wall using an inverting suture technique. The dogs in the Fascia lata group were subjected to partial cystectomies followed by grafting using fascia lata which was harvested from the thigh region. The graft was sutured to the bladder using the inverting suture pattern. The results revealed that the animals in both groups were healthy throughout the experiment except two animals in the control group showed urinary incontinence at the early post-operative period. One animal in the fascia lata group showed incontinence and another one displayed arching of the back in the first three days post-operation. The ultrasonographic and radiographic evaluation revealed a well-contoured bladder without any leakage. The bladder volume was significantly decreased in the control group post-operatively compared to the pre-operative manual measurement. However, there was no significant variation in the bladder volume pre- and post-grafting in the fascia lata group when measured manually and radiographically. Ultrasound is considered an unreliable method for measuring bladder volume. The results showed that fascia lata is an easily harvested tissue used for grafting the urinary bladder. It causes no complications (leakage, stone formation), and it keeps bladder capacity within normal or close to normal.

Keywords: Dogs, fascia lata, autograft, urinary bladder, cystectomy

INTRODUCTION

The anatomy and physiology of the urinary bladder can be disrupted by many diseases, resulting in restricted urination (Walters and Weber, 2000). The diseases

that can reduce bladder capacity, include neurogenic, carcinogenic, rhabdomyosarcoma, and neurofibromatosis, multiple surgeries, patent urachus excision, devitalized tissue following bladder rupture, and inflammatory diseases like recurrent interstitial cystitis (Kispal *et al.*, 2011; Valsangkar *et al.*, 2016). Cystectomy is recommended for the majority of the above-mentioned affections (Granger *et al.*, 2020; Ahmed *et al.*, 2022).

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Augmentation cystoplasty (AC) is a reconstructive surgery after partial cystectomies that aims to preserve the normal bladder capacity and prevent renal impairment in animals and humans through the decrease of intravesicular pressure (Salehipour *et al.*, 2016). Different synthetic biomaterials, as well as autologous, homologous, and heterologous tissues have been used in AC (Breen *et al.*, 2015).

Previous studies have established the use of various grafts for repairing and augmenting the urinary bladder, such as gastric and intestinal grafts, which are still the gold standard tissues for augmentation cystoplasty (Kispal *et al.*, 2011; Abol-Enein *et al.*, 2012; Gonçalves *et al.*, 2021), but they were linked with considerable morbidity (Kropp *et al.*, 1996; Pozzi *et al.*, 2006; Sabetkish *et al.*, 2014). In a previous study, two sources of tunica vaginalis grafts were used: one harvested from sheep and the other from dogs. The dog-derived tunica vaginalis graft produced effective, durable, and agreeable results, while the sheep-derived graft was ineffective in augmenting cystoplasty in dogs. The changes of results might be attributed to the species. The uses of tunica vaginalis as a graft may indicate that the graft must be harvested only from males to be used in both sex and this is considered a limitation of this type of graft (Ahmed *et al.*, 2022). In previous studies, it has been demonstrated that biodegradable, collagen-based materials induce native bladder regeneration (Kambic *et al.*, 1992; Elbahnasy *et al.*, 1998). These materials can be quite expensive or require a considerable amount of preparation, such as porcine small intestine submucosa (SIS) (Kropp *et al.*, 1996) and bladder acellular matrix grafts (BAMGs) (Probst *et al.*, 2000).

There are two published papers about the use of fascia lata (FL) for augmentation cystoplasty in dogs and rabbits (Yonez *et al.*, 2019; Ekder and Mahdi, 2021). In FL, collagen fibers are arranged in a three-dimensional network with a small amount of elastic fibers, which gives it sufficient strength and flexibility. Therefore, it is commonly utilized to reconstruct a variety of

damaged tissues (Maksymowicz *et al.*, 2012). Besides its easy harvest, it possesses other properties, such as low immunologic and inflammatory effects, non-toxic effects, low cost, and increased resistance to bacterial contaminations (Yonez *et al.*, 2019). It has been used in the reconstruction of the abdominal wall in animals (Disa *et al.*, 1996), as a substitute for repairing mucosal defects in the oral cavity of dogs (Ugurlu *et al.*, 2004), as well as in the repair of canine perineum and diaphragmatic hernias (Suzuki *et al.*, 2002; Bongartz *et al.*, 2005; Guérios *et al.*, 2017). Fascia lata can also be used successfully for reconstructing urethral defects and urethral fistulas in dogs (Atalan *et al.*, 2005; Ayyildiz *et al.*, 2006; LEE *et al.*, 2019).

The current study aimed to investigate the effectiveness of using autologous fascia lata for augmentation cystoplasty in dogs. Special focus was given to clinical, ultrasonographic, and radiographic evaluation, as well as measurement of bladder volume or capacity.

MATERIALS AND METHODS

1. Study design

The study was conducted under the guidelines of the Faculty of Veterinary Medicine, Assiut University, Egypt, in accordance with the OIE guidelines for the use of animals in research under No. 06/2024/0181. Additionally, the Institutional Animal Care and Use Committee of Assiut University's Faculty of Veterinary Medicine approved the study.

Ten healthy mongrel dogs of both sexes weighing between 9 and 20 kg (mean 13.85 Kg) and aged between 1 and 3 years (mean 1.9 years) were subjected to the following experimental study. Standard dog food was provided to the dogs, and they had free access to water. Before the study, the dogs were housed at the Faculty of Veterinary Medicine, Assiut University, for two weeks for close observation and acclimatization. Clinical data collected during the acclimatization period indicated that the

animals were healthy. The dogs were divided into two equal groups. The control (C) group underwent ventral partial cystectomies followed by suturing the remaining wall using a 4/0 braided lactometer* 9-1 (polysorb; Tyco Healthcare, USA) and a continuous inverting suture pattern. The dogs in the Fascia lata (FL) group were subjected to partial cystectomies followed by the application of a fascia lata graft at the ventral bladder defect, which was then sutured to the wall using 4/0 polysorb and a continuous inverting suture pattern.

2. Animal preparation and anesthesia

All the dogs were closely monitored for two weeks before the study. They received a subcutaneous injection of Ivermectin at a dose of 0.2mg/kg, given twice at a 14-day interval. In addition, they were administered Cefotaxime antibiotic at a dose of 22mg/kg IM 24 hours before the surgery. The dogs underwent a 12-hour fasting period before the surgery and were pre-medicated with atropine sulfate at a dose rate of 0.03mg/kg IM. Following this, 2% Xylazine Hcl (Xylaject 20 mg/mL; Adwia Co. S.A.E. 10th Ramadan City, Egypt) at a dose of 2 mg/kg IM was injected. Ketamine HCL 5% (Ketamax 50; Troikaa Pharmaceuticals Ltd. India) at a dose of 5 mg/kg was injected IM after 10 minutes of xylazine administration. Later, the dogs received a 2.5% solution of thiopental sodium (Upper Egypt Pharmaceuticals (UP Pharma) for EPECO; 10th of Ramadan City, Egypt) in a prepared dose of 20 mg/kg via an intravenous cannula (20 G cannula applied into the cephalic vein). The thiopental sodium was injected very slowly, until the loss of reflexes and apnea were noticed in the animals. If apnea lasted more than 20-30 seconds, the animals were subjected to cardio-respiratory resuscitation. The abdominal region and surface of the left thigh were prepared aseptically in a routine manner before the operation. The urinary bladder was emptied using an 8F Foley catheter, which was fixed in place.

3. Preparation of the dog's FL graft

The FL graft was obtained and prepared according to Ekder and Mahdi (2021). The surgeon was positioned facing the lateral surface of the left thigh while the dogs were lying on their right sides. The lateral side of the leg was incised longitudinally, about 5 cm above the lateral tibial epicondyle, and connecting the lateral femoral greater trochanter. To avoid injuring the iliotibial tract, the dissection was carefully performed. A 3 x 4 cm patch of fascia lata was harvested and placed in sterile phosphate buffer saline. The fascial defect was left open, and the surgical wound was closed in two layers. Subcutaneous tissues were closed using 2-0 Polyglactin 910 (Vicryl, Ethicon, Inc., Somerville, New Jersey, USA) in a simple continuous pattern, and 0 polysorb was used in a simple interrupted pattern to close the skin.

4. The augmentation cystoplasty (AC) of dogs using FL autograft

A 7 cm mid-line incision was made post-umbilical and extended downward to access the urinary bladder. After the bladder was exposed and emptied, moist, sterile laparotomy towels were used to isolate it from the rest of the abdominal organs. To handle the bladder, a stay suture was placed at the apex. A small incision was made on the ventral surface of the bladder with a scalpel to remove a 2x3cm section of the bladder wall "partial cystectomy". Then, the FL graft was sutured to the edge of the bladder wall with 4-0 absorbable polysorb in a water-tight continuous inverting suture pattern (Figure 1). The grafted bladder was filled with 60 mL of distilled water using a previously inserted polyethylene urinary catheter to check for any leakage. The bladder was covered by a layer of omentum. The latter was anchored to bladder by two stitches. The urinary bladder was reduced to its normal site. The abdominal wall was closed by a simple continuous suture pattern for the Linea Alba and subcutaneous tissue using 0 polysorb, and the skin was closed by a simple interrupted pattern using 0 polysorb.

The animals in the control group were subjected to the whole surgical procedure, as in the FL group, but the bladder was sutured and closed without using a graft by continuous inverting suture technique (Figure 2).

5. Postoperative management

The dogs received broad-spectrum antibiotics (Amoxicillin-clavulanic acid combination; Synlux RTU; Zoetis, 1ml/20 kg daily for 5 days IM), and Meloxicam (2% MOVAC Adwia Co. 10th of Ramadan City, Egypt) 0.5 mg/kg S/C every 48 hours (3 injections). The surgical site and stitches were checked daily for any complications until the skin sutures were removed 12 days postoperatively.

6. Postoperative evaluation

Dogs in the current study were observed till the third month postoperatively for general health status, food intake, urination behavior, and frequency, as well as abdominal distension. Ultrasonography was performed on the dogs in the 11th week following surgery, using a 5 MHz micro convex and/or 5:8 MHz linear ultrasound transducers (Edan DUS 60 Vet; China).

The retrograde negative, and positive cystogram techniques were performed 11 weeks postoperatively, as described by Marolf and Park (2013). Lateral and Ventrodorsal plain radiographs were obtained before the contrast study. For positive cystography, the bladder was emptied using a Foley catheter, which was applied in the urethra into the bladder. The urinary bladder was inflated slowly using diluted iodinated contrast media (100-150 mg I/ml; Urografin 76%, Bayer (Pty) Ltd, South Africa), until full capacity was reached, which was detected through digital manipulation of the bladder from outside, and presence of resistance during progressive injection. The mAs were increased by about 30% to avoid underexposure. Radiographic images of the abdominopelvic region were taken for each dog, including lateral and ventro-dorsal

views. The pneumocystography was performed as positive cystography except the positive contrast media was replaced with room air.

7. Bladder capacity evaluation was performed using three different methods (manually, ultrasonographically, and radiographically). Manually, the dogs were placed in a supine position and given light anesthesia. The bladder capacity was assessed before the experiment (baseline) and 12 weeks later by measuring the amount (mL) of normal saline needed to fill the UB after emptying without resistance using an 8F Foley catheter (Atalan *et al.*, 1998; Yonez *et al.*, 2019).

The ultrasonographic and radiographic bladder volume measurements were calculated using the following equation: Bladder volume = length x width x height x 0.52 (Araklitis *et al.*, 2019).

The minimum and maximum urinary bladder volume was measured according to previous studies. 3.5 ml/kg was the minimum, while 20 ml/kg was the maximum (Atalan *et al.*, 1999; Hamaide *et al.*, 2003; Hu *et al.*, 2016). The results of bladder volume, that was measured manually, radiographically, and ultrasonographically for each animal, were compared with the minimum and maximum volume.

8. Statistical analysis

All quantitative data were expressed as the mean \pm standard error (SE). SPSS software version 21 (IBM Corp., Armonk, NY, USA) was used for statistical analysis. First, Levene's Test of Equality of Error Variances was used. The result of this test is a significant Kruskal-Wallis nonparametric test instead of one-way ANOVA to compare the measured bladder volume using different ways within and between the control and FL groups. The P-value was considered significant when the P value was lower than 0.05. One-way ANOVA is used to detect the difference between each physical parameter (temperature, heart rate and respiratory rate)

in the control and FL groups at different times.

RESULTS

1. Clinical findings

The postoperative clinical follow-up immediately after the operation until 3 months later revealed that all dogs included in the present study survived till the end of the study. The water intake started after the recovery of anesthesia. The feed intake was resumed normally about 24-36 hours post-operatively. The follow-up of urination was concerned in the first 5 days after the operation, with careful inspection and visualization of the contour of the abdomen. The animals in two groups voided urine smoothly and normally without any effort. The urine was physically normal, without any clear changes that may affect its normal color, such as blood or pus. All animals were in good general health conditions for 3 months post-operatively. The results revealed no significant changes in the physical parameters (temperature, heart rate, and respiratory rate) in all dogs between the pre- and postoperative periods (till the 8th week post-operation) in the control and FL groups (Table 1). The results revealed that the animals in both groups were healthy throughout the experiment, except two animals in the control group showed urinary incontinence at the early post-operative period (first three days). One animal in the fascia lata group showed incontinence and another one displayed arching of the back in the first three days post-operation.

The ultrasonographic findings were normal in all dogs in two groups. The urine appeared anechoic causing a distal acoustic enhancement. The pseudo-sludge was clear in some cases in two groups, which disappeared with agitation of the bladder and change of the orientation of the transducer. The bladder wall was intact, hypoechogenic, and well-demarcated from the anechoic bladder contents. The bladder wall thickness at the ventral aspect (seat of operation and its surroundings) was 1.1 mm and 1.7 mm in

the control and FL groups respectively. The bladder wall was clearly distinguished into 3 layers ultrasonographically. Two echogenic layers sandwiched a hypoechoic layer (Figure 3). The thickness of the bladder wall was increased towards the seat of grafting in FL groups, but the control group showed a regular wall with an even thickness along the whole ventral aspect of the urinary bladder (Figure 3). The colon was located dorsally in the far field in three animals in both groups. It caused a mild indentation of the dorsal bladder wall (Figure 3).

The bladder size was variable according to its volume and whether the animal was recently voided or not. The bladder was at its normal position in the caudoventral aspect of the abdomen, without any displacement or deviation in all animals in the two groups. The bladder shape was variable in animals from ovoid, ellipsoid, or rounded. The bladder density on the radiograph was homogeneous and free from any filling defects in all animals in two groups, either on the pneumocystography or positive cystography. The contrast media is evenly distributed all over the bladder. The bladder wall was regular, smooth, and intact. It was free from any point of adhesion with surroundings (Figures 4&5). The ventral bladder wall was intact and devoid of any rent, abnormal thickness. There was no substantial difference in the bladder wall thickness, especially at the ventral aspect on the pneumocystogram in all animals in both groups. It ranged from 0.6 to 0.7 mm. However, there were some changes in the FL group, where the bladder wall appeared undulating or in waving form.

Generally, there was a significant difference in the bladder volume measured in different ways between the control and FL groups. The ultrasound-measured bladder volume was clearly lower than the manually measured before the operation, radiography and using the maximum bladder volume (20 ml/kg). The P values were 0.001, 0.041, and 0.00 respectively. Logically, there was a significant decrease in the value of measured

bladder volume using minimum previous data of bladder volume (3.5 ml/kg) relative to the maximum bladder volume (20 ml/kg). P value was 0.00. Also, the minimum bladder volume (3.5 ml/kg) was substantially lower than the pre-operative bladder volume (P= 0.03). (Figures 6&7).

In the control group, there was a significant decrease in the measured bladder volume manually post-operatively relative to the pre-

operative manual measured volume (P= 0.04). The statistical analysis showed a lack of significant change between the measured bladder volume in the fascia lata group between the pre- and post-operative manual measurement (P= 0.746). The difference between the measured bladder volume using different ways in the control and fascia lata groups was summarized in Table (2) and was clear in Figures (6&7).

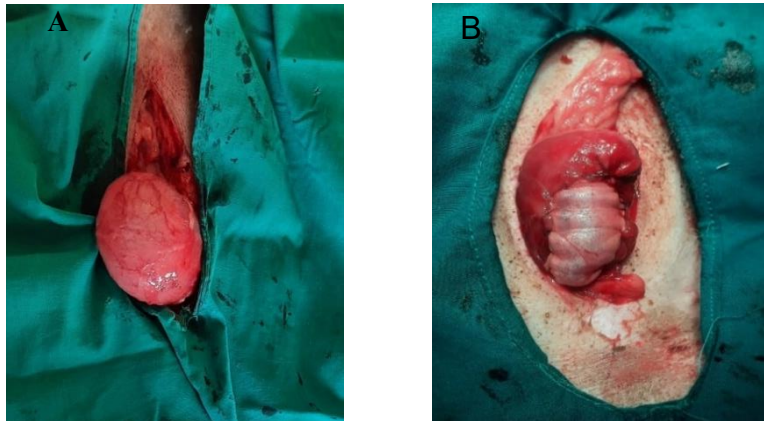


Figure (1). A. The urinary bladder before (A), and after grafting using fascia lata graft (B)

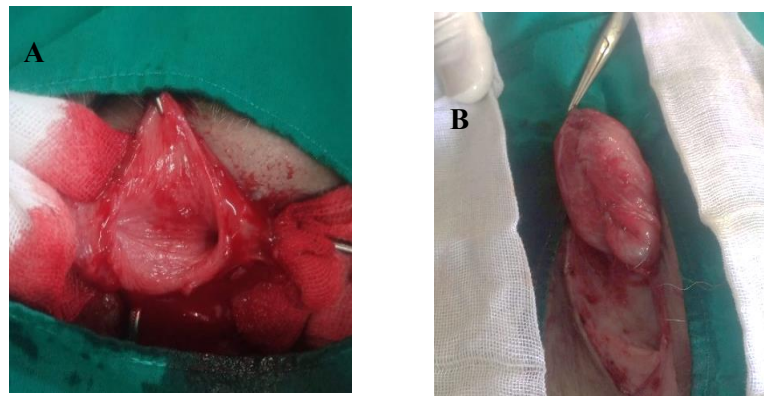


Figure (2): A. The urinary bladder after resection of a part of it in the control group, B. The suturing of UB after ventral wall resection using inverting technique without using of graft.

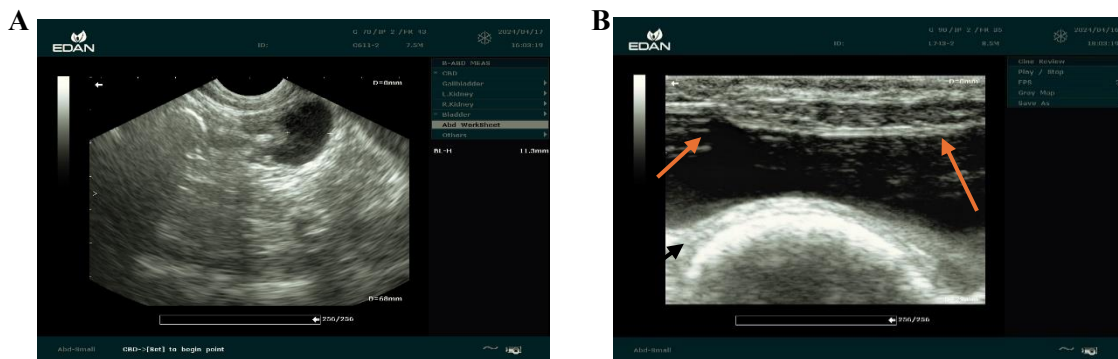


Figure (3): Ultrasonography of the UB in the control animals (A), and fascia lata group animals (B) at the 11th week post-operatively. There was a marked thickening of the ventral wall of the UB at the seat of grafting in the fascia lata group (orange arrows). Notice the indentation of the UB due to the colon (black arrow).

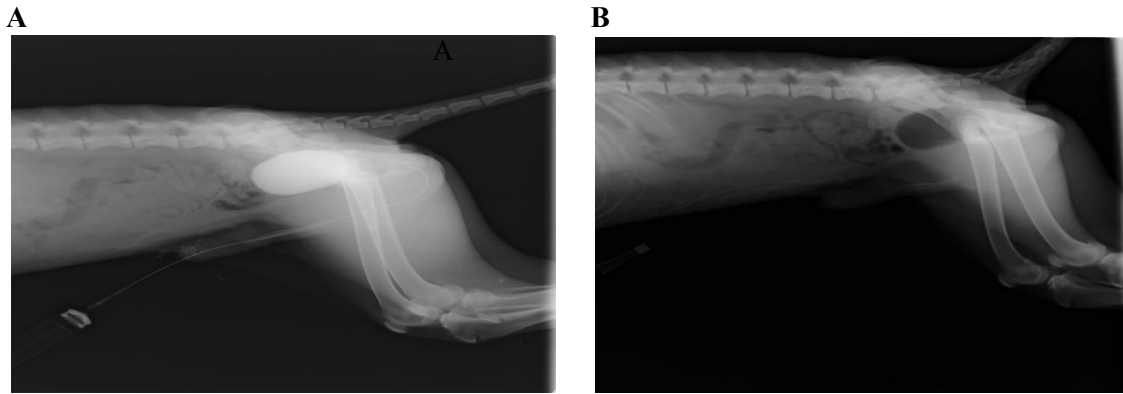


Figure (4): Radiographic evaluation of the urinary bladder using positive **A**, and negative **B** contrast media in the control group at the 11th week post-operation. The figures displayed the small-sized UB while keeping the smooth contour of the UB.

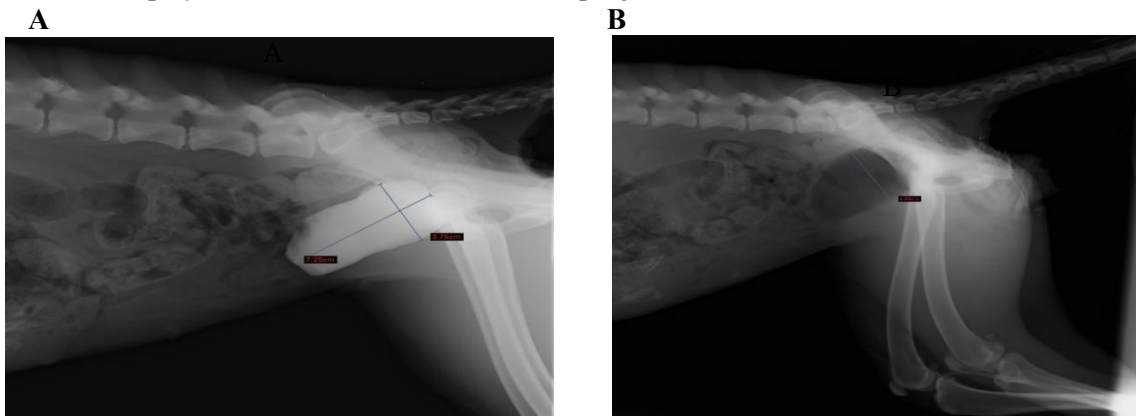


Figure (5): Radiographic evaluation of the urinary bladder using positive **A**, and negative **B** contrast media in the Fascia lata group at the 11th week post-operation. The figures displayed the normal size of the UB but with a slight change in the outer contour of the UB.

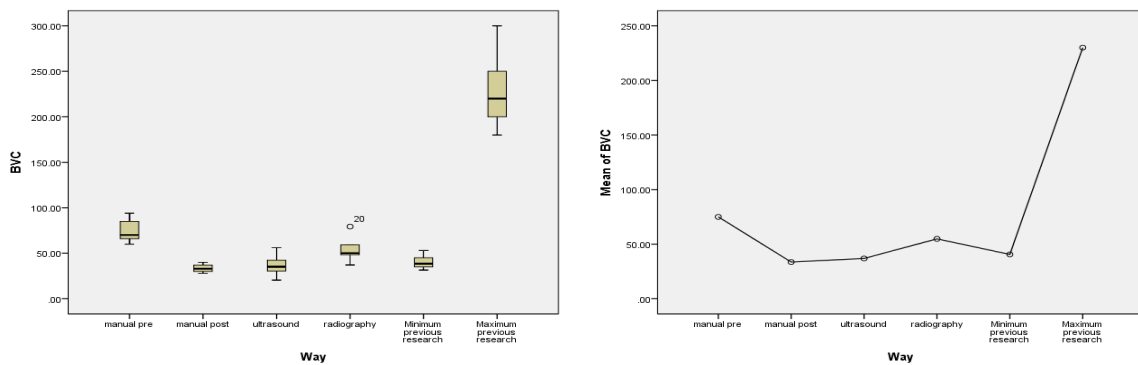


Figure (6): The measured bladder volume in the animals of the control group was calculated using different ways post-operatively and compared to the pre-operative manual measurement.

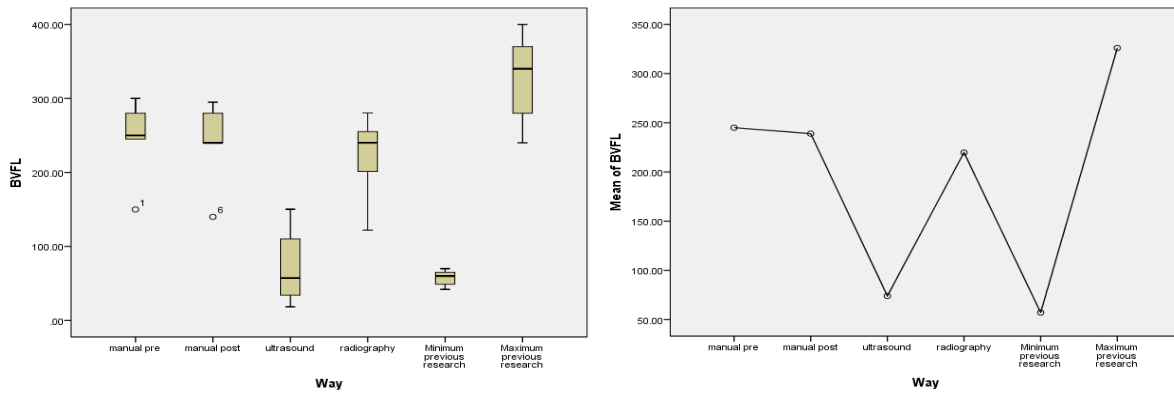


Figure (7): The measured bladder volume in the animals of fascia lata group was calculated utilizing different ways post-operatively and compared to the pre-operative manual measurement.

Table 1: The physical parameters (body temperature, heart rate, and respiratory rate) in the control and fascia lata groups. The data were described in mean± SE.

Time	Control (mean± SE)			Fascia Lata group (mean± SE)		
	T (°C)	HR (b/m)	RR (breath/m)	T (°C)	HR (b/m)	RR (breath/m)
Pre-operative	38.3± 0.21	73.6± 2.7	17.8± 0.86	38.22± 0.1	78.2± 0.92	17.6± 0.98
48 hours post	38.16± 0.09	73.4± 2.6	22.8± 0.86	38.14± 0.05	78± 0.84	20.4± 1.21
1-week post	38.38± 0.14	75.6± 1.8	20.4± 0.51	38.18± 0.07	78.4± 0.51	18.6± 1.21
2 weeks post	38.12± 0.16	73.8± 2.5	17.0± 0.71	38.02± 0.09	78± 0.32	18.6± 1.03
4 weeks post	38.28± 0.08	74.4± 3.5	16.4± 0.75	38.02± 0.07	79.2± 0.97	19.2± 1.16
8 weeks post	38.18± 0.07	75.4± 1.9	18.2± 0.58	38.2± 0.08	79± 0.77	19± 0.71

T: temperature, HR: heart rate, RR: respiratory rate
 °C: Celsius
 b/m: beats per minute
 breath/m: breath per minute

Table 2: The bladder volume in the control and fascia lata groups was measured utilizing different ways. The data are expressed in mean± standard error. The P value is considered significant when it was lower than 0.05. The data were compared within the same group (column). The control group was superscribed with Capital letters, while the fascia lata group was superscripted with small letters. There were significant differences (0.05 > P) between values superscribed with the same letters.

Way of measurement of bladder volume	Control Mean± SE	Fascia lata Mean± SE
Manual pre-operative	75± 6.3 ^{ACE}	245± 25.79 ^{ag}
Manual post-operative	33.6± 2.2 ^{AB}	239± 27.04 ^{bh}
Ultrasound	36.91± 5.98 ^{CD}	74.05± 24.56 ^{abcd}
Radiography	54.84± 7.1 ^G	219.79± 27.6 ^{ce}
Minimum previous research (3.5 ml/kg)	40.6± 3.82 ^{EF}	57.2± 5.15 ^{efgh}
Maximum Previous research (20ml/kg)	230± 20.98 ^{BDFG}	326± 29.26 ^{df}

DISCUSSION

The current study was conducted to evaluate the effectiveness of the grafting of the

urinary bladder using fascia lata in dogs. The study investigated whether the fascia lata could be used as a substitute after a bladder defect and keep the bladder capacity within

normal or close to normal. The results of the present study declared the effectiveness of the fascia lata to regain the normal contour and capacity of the urinary bladder. This was obvious when the bladder volume was measured manually before and after grafting. There was no significant difference between the measured volume pre- and post-grafting. On the other hand, the measured bladder volume before and after the operation in the control group had decreased substantially. These results about the successful use of the fascia lata for augmentation cystoplasty were consistent with the outcomes of a previous study in rabbits (Yonez *et al.*, 2019) and another in dogs (Ekder and Mahdi, 2021). However, the current study confirmed the maintenance of normal bladder capacity after using the fascia lata for grafting.

The present study revealed that the radiographic calculation of the bladder volume was reliable and was close to the manual way of bladder volume measurement. In the fascia lata group, there was no difference in the measured bladder volume between the radiography and both the pre- and post-grafting manual way of measuring. There was no significant change in the bladder volume between the radiographic method and both of the pre and post-operative manual methods for calculation of the bladder volume in the control group, but there was a substantial difference between the pre- and post-manual methods in the same group. Due to one view showing only two dimensions of the urinary bladder, two views at least are required for obtaining three dimensions for appropriate calculation of the bladder volume (Thrall, 2013).

Multiple studies have utilized ultrasound to measure bladder volume in both humans and animals (Dicuio *et al.*, 2005; Ghani *et al.*, 2008; Kendall *et al.*, 2020). However, the use of ultrasound in our current study yielded unreliable results. We observed a significant decrease in the measured volume when ultrasound was employed, as compared to manual measurement,

radiography, and maximum bladder volume (20ml/kg). This decrease was observed in both the fascia lata and control groups. The estimation of bladder volume not capacity was directly measured according to the equation of Araklitis *et al.* (2019). When measuring bladder volume, a volume of urine within the bladder was not considered. Sometimes the dogs' bladders were full, empty, or recently voided. Thus, the ultrasound in our study measured only the remaining bladder volume, while the manual and radiographic methods were preceded by bladder inflation. We consider it a limitation of the present study, and ultrasound measurement of bladder volume in dogs requires further investigation, and the bladder should be filled with distilled water or physiological saline before measurement. The results of the current study showed that the dogs were in good overall health throughout the entire experiment, after the grafting of the urinary bladder (UB) using FL. However, two dogs exhibited signs of urine incontinence and arching of the back during urination in the first three days following the surgery. This may be attributed to pain that was elicited with laparotomy and cystoplasty. Also, the urination process needs an increase in the intra-abdominal pressure, obtained from the contraction of the abdominal muscles. In the control group, urinary incontinence may be ascribed to the decrease of bladder capacity and threshold relative to the production volume of urine by kidneys. Bladder tone often decreases during the first 10 days after cystoplasty. This is considered normal in the early postoperative period and may suggest satisfactory healing at the grafting site (Dewangan *et al.*, 2013).

Urine leakage and stone formation were not observed in this study. It is postulated that the choice of the suture type and pattern, as well as the tissue of the FL, may play a role in preventing these complications.

Several studies (Abass *et al.*, 2011; Al-Asadi and Khwaf, 2014; Xiao *et al.*, 2017) recommended the use of a single-layer

running technique in bladder augmentation and cystotomy procedures. According to this technique, sutures in the bladder tissue are less likely to leak, and the procedure is quicker and stronger. Polydixenon suture material was also found safe for use in cystotomy and cystoplasty procedures involving homologous FL graft (Kosan *et al.*, 2008; Al-Asadi and Khwaf, 2014; Yonez *et al.*, 2019). The use of FL graft for cystoplasty in rabbits did not result in stone formation. Furthermore, the FL tissue did not exhibit mucus secretion, which can lead to stone formation, as observed in the stomach or ileum.

CONCLUSIONS

Based on the clinical, ultrasonographic, and radiographic results, Fascia lata is an easily harvested tissue from animals to be used for grafting the urinary bladder after its cystectomy. It causes no complications (leakage, and stone formation), as well as it keeps the bladder capacity within normal or close to normal.

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الاستخدام الجراحي لطعوم اللفافة العريضة كبديل لجدار المثانة

بعد الاستئصال الجزئي للمثانة في الكلاب

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تهدف الدراسة الحالية إلى تقييم مدى فعالية اللفافة العريضة لتطعيم المثانة البولية. تم إجراء التقييمات السريرية والموجات فوق الصوتية والشعاعية. أجريت الدراسة على عشرة كلاب هجينة سليمة من كلا الجنسين. وتم تقسيمهم إلى مجموعتين متساويتين. خضعت المجموعة الضابطة لعملية فتح البطن واستئصال جزء من جدار المثانة (معظم الجدار البطني للمثانة) متبوعة بخياطة الجدار المتبقي باستخدام تقنية الخياطة المقلوبة. خضعت مجموعة اللفافة العريضة لعملية فتح البطن واستئصال جزء من جدار المثانة (معظم الجدار البطني للمثانة) متبوعة بالتطعيم باستخدام اللفافة العريضة التي تم حصادها من منطقة الفخذ. تمت خياطة رقعة اللفافة العريضة في المثانة باستخدام نمط الخياطة المقلوبة. أظهرت النتائج أن الحيوانات في كلا المجموعتين كانت صحية طوال مدة التجربة باستثناء حيوانين في المجموعة الضابطة أظهر سلس البول في الفترة المبكرة بعد العملية الجراحية. أظهر أحد الحيوانات في مجموعة اللفافة العريضة سلس البول بينما أظهر حيوان آخر تقوس الظهر في الأيام القليلة الأولى. أظهر التقييم بالموجات فوق الصوتية والتصوير الشعاعي أن المثانة ذات محيط جيد. وانخفض حجم المثانة بشكل ملحوظ في المجموعة الضابطة بعد العملية الجراحية مقارنة بالقياس اليدوي قبل العملية. ومع ذلك، لم يكن هناك اختلاف كبير في حجم المثانة قبل وبعد التطعيم في مجموعة اللفافة العريضة عندما تم قياسها يدويًا وشعاعيًا. تعتبر الموجات فوق الصوتية طريقة غير موثوقة لقياس حجم المثانة. وأخيرًا، تعتبر اللفافة العريضة نسيجًا جيدًا يمكن الحصول عليه بسهولة من الحيوان ذاته واستخدامه لتطعيم المثانة البولية. كما ان اللفافة العريضة لا تسبب أي مضاعفات (تسرب، تكوين حصوات). كما أنها تحافظ على سعة المثانة ضمن المعدل الطبيعي أو بالقرب من المعدل الطبيعي.