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RESEARCH ARTICLE

Excision Arthroplasty of the Hip Joint in Dogs: The Role of Age, Weight, Degenerative Joint Disease on the Outcome

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Summary

The present clinical study was to evaluate the relationship between weight, degenerative joint disease (DJD) and age on the outcome in dogs underwent excision arthroplasty operation. 105 dogs have been referred to clinic with lameness on hindlimb. Dogs were younger than 1 year (50 dogs), 1 to 5 years (24) and older than 5 years (31). The rest of them were less than 10kg and the rest were heavier than 10kg. Lameness during walking was scored between zero to 5. Radiographic findings were showed that degenerative joint change, hip dysplasia and luxation. Excision arthroplasty of the hip joint was performed. Walking status was examined postoperatively. Intra-group data showed in dogs younger than 1 year, weight was not an effective factor, and association between DJD and the outcome was statistically significant in both weights. DJD had effective role in dogs more than 10kg in comparison to less than 10kg. The association between DJD and the outcome wasn't statistically significant in dogs 1 to 5 years in both weights. In elder dogs, weight wasn't a main factor, and association between DJD and outcome was statistically significant in both weights. In latter group, DJD had effective role on the outcome in dogs less than 10 kg in comparison with more than 10 kg. The authors suggest the weight is not as much effective as age among groups of study after Excision arthroplasty of the hip joint.

Keywords: *Excision arthroplasty, Degenerative Joint Disease, Age, Weight*

Köpeklerde Kalça Eklemi Eksizyonu Artroplastisi: Yaş, Ağırlık ve Dejeneratif Eklem Hastalığının Sonuç Üzerine Etkisi

Özet

Bu klinik çalışma, köpeklerde kalça eklemi eksizyonu artroplastisi geçiren hastalarda yaş, ağırlık ve dejeneratif eklem hastalığı (DEH) arasındaki ilişkinin sonuç üzerine etkisini değerlendirmektedir. Arka ayaklarında topallık şikayeti ile kliniğe sevk edilen 105 adet köpek kullanılmıştır. Köpeklerin yaş dağılımı, 1 yaşından genç (50 köpek), 1 ile 5 yaşlı (24) ve 5 yıldan yaşlı (31) şeklindeydi. Bunlardan geri kalanlar, 10 kg'dan az ve diğer geri kalanı ise 10 kg'dan daha ağır hayvanlardı. Yürüyüş sırasında topallığa sıfır ile 5 arasında skor verildi. Radyografik bulgular ile dejeneratif eklem değişikliği, kalça displazisi ve çıkık belirledi. Kalça ekleminin eksizyon artroplastisi yapıldı ve yürüme durumlarının takibi gerçekleştirildi. Grup içi veriler, 1 yaşından genç köpeklerde ağırlığın etkili bir faktör olmadığını ve DEH ile sonuç arasındaki ilişkinin her iki ağırlıkta istatistiksel olarak anlamlı olduğunu gösterdi. DEH'in 10 kg'dan daha az köpeklerde 10 kg'dan daha fazla olanlara göre etkili bir role sahip olduğu görüldü. DEH ile sonuç arasındaki ilişkinin her iki ağırlıktaki 1- 5 yaş arası köpeklerde istatistiksel olarak anlamlı olmadığı gözlemlendi. Daha yaşlı köpeklerde, ağırlığın başlıca faktör olmadığı ve DEH ile sonuç arasındaki ilişkinin ilişkinin her iki ağırlıkta da istatistiksel olarak anlamlı olduğu belirlendi. Sonraki grupta, DEH'in 10 kg'dan daha az köpeklerde 10 kg'dan daha fazla olanlarla karşılaştırıldığında sonuç üzerine etkili bir role sahip olduğu gözlemlendi. Sonuç olarak, kalça ekleminin eksizyon artroplastisi sonrası yapılan çalışma gruplarında ağırlığın yaş kadar etkili bir faktör olmadığı düşünülmektedir.

Anahtar sözcükler: *Eksizyon artroplastisi, Dejeneratif eklem hastalığı, Yaş, Ağırlık*

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INTRODUCTION

Coxo-femoral joint diseases are caused by trauma and congenital disorders [1-3]. Sub-luxation and luxation were induced by trauma and congenital disorders such as dysplasia [4,5]. These conditions result in osteoarthrosis and the following changes such as the reduction of range of motion, pain, lameness, capsular hypertrophy, schiatic nerve injury, change in anatomic patellar position and osteo-arthritis in distal and proximal joints [6]. The clinical signs and lameness depend on velocity of trauma, ethiology, and the degree of arthritis, age, and weight [5]. The anchor suture, toggle fixation, transarticular pin, dorsal capsul-orraphy, transposition of the greater trochanter, triple pelvic osteotomy, femoral head and neck ostectomy (FHO) and total hip replacement (THR) are surgical options in managing acute trauma and chronic diseases of joint [2]. Since the equipments and required prosthesis for total hip replacement are unavailable in majority of clinics and some countries and it is also an expensive technique (patient restriction for at least 8 weeks and the FHO, the latter procedure is suggested. In some studies, outcome of FHO in dogs over 10 kg is questionable. Many investigations showed that the influential factors in prognosis are history, age, post-operative care, weight, and co-existing disease [5,7,8]. The majority of literature has shown that weight has the main role in prognosis following FHO among the other mentioned factors. For this reason, using FHO is limited for dogs under 10 kg and cats.

Therefore, this clinical investigation was conducted to evaluate the role of age, weight, DJD and their comparison to each other in prognosis after excision arthroplasty. In present study, the findings have been based on subjective gait analysis at walk and variable evaluation of clinical finding was lameness.

MATERIAL and METHODS

One hundred and five, small and large breed client-owned dogs *(Table 1)* had been referred to small animal clinics with history of congenital, acute trauma, chronic changes of hip joint and signs as lameness, pain and impaired function on hindlimb *(Tables 2, 3, 4)*. Dogs were less than 1 year (Group I, 50 dogs), between 1 to 5 years (Group II, 24 dogs) and more than 5 years (Group III, 31 dogs). Fifty-two dogs out of 105 were less than 10 kg/body weight and the rest over than 10 kg/bodyweight. Then lameness at walk was scored between zero (normal walk) to 5 (continuous non-weight bearing lameness). Hindlimbs and hip joint radiographs were taken ventrodorsally (hip joint), and laterally (hindlimb and hip joint) and cranio-caudally (hindlimb). Degenerative joint changes (DJD), coxo-femoral luxation and different grade of hip dysplasia were seen radiographically.

Surgical Treatment

After physical restraint, dogs received dextrose-saline solution at (20 ml/kg/h) preoperative medication with atropine sulfate (0.03 mg/kg, SC) half an hour before anesthesia. Cefazoline (22 mg/kg, IV) was administrated as a prophylactic antibiotic before operation. Diazepam and ketamine hydrochloride combination (0.27 mg/kg and 5.5 mg/kg, IV) were administrated as an induction and propofol (7.5 mg/kg, IV) for maintenance of anesthesia.

Table 1. *The distribution of cases*
Table 1. *Olguların dağılımı*

Weight	Lameness Score						Total
	Zero†	1‡	2Φ	3Θ	4ɔ	5Ψ	
< 10kg	0	0	0	25	23	4	52
> 10kg	0	0	0	28	23	2	53
Total	0	0	0	53	46	6	105

† *Walk normally* ‡ *Slight lameness* Φ *Obvious weight-bearing lameness* Θ *Severe weight-bearing lameness* ɔ *Intermittent non-weight-bearing lameness* Ψ *Continuous non- weight-bearing lameness*

Table 2. *Evaluation at a walk for lameness scoring in dogs less than 1 year before operation*
Table 2. *Bir yaşından genç köpeklerde operasyon öncesi yürüyüş üzerine topallık skorlarının değerlendirilmesi*

Bodyweight	Joint Changes	Lameness Scoring						Total
		Zero †	1‡	2Φ	3Θ	4ɔ	5Ψ	
< 10 kg	Non-DJD (A.T.)	0	0	0	3	4	0	7
	DJD (C.D.)	0	0	0	3	7	2	12
> 10 kg	Non-DJD (A.T.)	0	0	0	0	2	0	2
	DJD (C.D.)	0	0	0	17	10	2	29

† *Walk normally* ‡ *Slight lameness* Φ *Obvious weight-bearing lameness* Θ *Severe weight-bearing lameness* ɔ *Intermittent non-weight-bearing lameness* Ψ *Continuous non- weight-bearing lameness, AT, Acute trauma; CD, Chronic disease*

The animals were positioned in lateral recumbency, and the leg is prepared from the lumbar to the tarsal joint. A craniolateral approach was made and hip was luxated, if the round ligament was intact, it was incised. For incising the round ligament, lateral traction was placed on the greater trochanter with bone-holding forceps and the femoral head was subluxated. This maneuver allowed the curved scissors to be placed into the joint to cut the round ligament. Then ostectomy was performed by externally rotating the limb to where the joint line of stifle is parallel to the operating table at the junction of the femoral neck and the femoral metaphysic. The accuracy of the bony cut line, a series three holes was predrilled along the line of osteotome and mallet to complete the cut. Once the femoral head and neck have been removed, irregularities of the cut surface of femoral neck were removed with rangeurs and electrical high speed hand-piece. In case the joint capsule existed, the suturing was done. The muscles, subcutaneous tissue and skin were closed using standard methods.

Post-operative cares included antibiotic therapy with Cefazoline (22 mg/kg, q 12 h, IV) for three days, Tramadol as pain management for three days (2 mg/kg, q 12 h, IM), passive range of motion (10 min twice a day) to achieve maximum rehabilitation for two weeks. Patient's activity was restricted for four weeks. Subjective gait analysis was done while the patients at all gaits walk toward and away from examiner; also in the sides and at a stand position. Then the outcome (lameness scoring) was divided into six scoring of zero to 5 *(Tables 5, 6, 7)*. The follow up was done at the end of the third month after the surgery.

Statistical Analyses

Data was analyzed using SPSS version 16.0 and Chi square test. Significant level was considered 0.05%.

RESULTS

All dogs tolerated femoral head and neck ostectomy (FHO) with no postoperative complications. The patients returned to normal or near-normal function utmost till the end of third months *(Table 5, 6, 7)*. Data analyzed showed that in dogs less than I year, weight was not an effective factor, and association between traumatic DJD and prognosis was statistically significant in dogs less than 10 kg (X^2=9.42, P=0.024) and over 10 kg (X^2= 22.75, P<0.001*)* *(Table 5)*, so dogs less than 10 kg showed less statistical correlation with DJD and outcome in comparison to dogs over 10 kg. Therefore, DJD has a more effective role in prognosis in dogs more than 10 kg in comparison to the ones less than 10 kg. The association between DJD and prognosis was not statistically significant in dogs 1 to 5 years either weighting less than 10 kg (X^2=5.69, P>0.05) or more than 10 kg (X^2=3.18, P>0.05) *(Table 6)*. In elder dogs (older than 5 years), weight was not a main factor, and association between DJD and prognosis was statistically significant in dogs less than 10 kg (X^2=13, P=0.004) and more than 10 kg (X^2=10, P=0.019), so dogs less than 10 kg showed more statistical correlation with DJD and outcome in comparison to dogs over 10 kg.

Table 3. *Evaluation at a walk for lameness scoring in dogs between 1 to 5 years before operation*
Table 3. *Birden beş yaşa kadar olan köpeklerde operasyon öncesi yürüyüş üzerine topallık skorlarının değerlendirilmesi*

Bodyweight	Joint Changes	Lameness Scoring						Total
		Zero †	1 ‡	2 Φ	3 Θ	4 ג	5 Ψ	
< 10 kg	Non-DJD (A.T.)	0	0	0	4	4	1	9
	DJD (C.D.)	0	0	0	1	3	0	4
> 10 kg	Non-DJD (A.T.)	0	0	0	4	3	0	7
	DJD (C.D.)	0	0	0	2	2	0	4

† Walk normally ‡ Slight lameness Φ Obvious weight-bearing lameness Θ Severe weight-bearing lameness ג Intermittent non-weight-bearing lameness Ψ Continuous non- weight-bearing lameness, AT, Acute trauma; CD, Chronic disease

Table 4. *Evaluation at a walk for lameness scoring in dogs more than 5 years before operation*
Table 4. *Beş yaş üzeri olan köpeklerde operasyon öncesi yürüyüş üzerine topallık skorlarının değerlendirilmesi*

Bodyweight	Joint Changes	Lameness Scoring						Total
		Zero †	1 ‡	2 Φ	3 Θ	4 ג	5 Ψ	
< 10 kg	Non-DJD (A.T.)	0	0	0	10	3	0	13
	DJD (C.D.)	0	0	0	4	2	1	7
> 10 kg	Non-DJD (A.T.)	0	0	0	3	3	0	6
	DJD (C.D.)	0	0	0	2	3	0	5

† Walk normally ‡ Slight lameness Φ Obvious weight-bearing lameness Θ Severe weight-bearing lameness ג Intermittent non-weight-bearing lameness Ψ Continuous non- weight-bearing lameness, AT, Acute trauma; CD, Chronic disease

Table 5. *Evaluation at a walk for lameness scoring in dogs less than 1 year three months after FHO*
Table 5. *Femur başı ve boynu ostektomisinden (FHO) üç ay sonra, bir yaştan genç köpeklerde yürüyüş üzerine topallık skorlarının değerlendirilmesi*

Bodyweight	Joint Changes	Lameness Scoring						Total	SS
		Zero †	1 ‡	2 Φ	3 Θ	4 ɔ	5 Ψ		
< 10 kg	Non-DJD (A.T.)	5	1	1	0	0	0	7	*
	DJD (C.D.)	6	5	1	0	0	0	12	
> 10 kg	Non-DJD (A.T.)	2	0	0	0	0	0	2	***
	DJD (C.D.)	13	14	2	0	0	0	29	

*† Walk normally ‡ Slight lameness Φ Obvious weight-bearing lameness Θ Severe weight-bearing lameness ɔ Intermittent non-weight-bearing lameness Ψ Continuous non- weight-bearing lameness, AT, Acute trauma; CD, Chronic disease; FHO, Femoral head and neck ostectomy; Significantly different; * P <0.05; ** P <0.01; *** P <0.001; SS, Statistical significant*

Table 6. *Evaluation at a walk for lameness scoring in dogs between I to 5 years three months after FHO*
Table 6. *FHO'dan üç ay sonra, 1 – 5 yaş arası köpeklerde yürüyüş üzerine topallık skorlarının değerlendirilmesi*

Bodyweight	Joint Changes	Lameness Scoring						Total	SS
		Zero†	1 ‡	2 Φ	3 Θ	4 ɔ	5 Ψ		
< 10 kg	Non-DJD (A.T.)	7	1	1	0	0	0	9	NS
	DJD (C.D.)	2	2	0	0	0	0	4	
> 10 kg	Non-DJD (A.T.)	4	2	1	0	0	0	7	NS
	DJD (C.D.)	0	3	1	0	0	0	4	

*† Walk normally ‡ Slight lameness Φ Obvious weight-bearing lameness Θ Severe weight-bearing lameness ɔ Intermittent non- weight-bearing lameness Ψ Continuous non- weight-bearing lameness, AT, Acute trauma; CD, Chronic disease; FHO, Femoral head and neck ostectomy; Significantly different; * P <0.05; ** P <0.01; *** P <0.001; SS, Statistical significant; NS, Non-significant*

Table 7. *Evaluation at a walk for lameness scoring in dogs more than 5 year three months after FHO*
Table 7. *FHO'dan üç ay sonra, 5 yaş üzeri köpeklerde yürüyüş üzerine topallık skorlarının değerlendirilmesi*

Bodyweight	Joint Changes	Lameness Scoring						Total	SS
		Zero†	1 ‡	2 Φ	3 Θ	4 ɔ	5 Ψ		
< 10 kg	Non-DJD (A.T.)	9	3	1	0	0	0	13	***
	DJD (C.D.)	3	3	1	0	0	0	7	
> 10 kg	Non-DJD (A.T.)	2	3	1	0	0	0	6	*
	DJD (C.D.)	1	2	2	0	0	0	5	

*† Walk normally ‡ Slight lameness Φ Obvious weight-bearing lameness Θ Severe weight-bearing lameness ɔ Intermittent non- weight-bearing lameness Ψ Continuous non- weight-bearing lameness, AT, Acute trauma; CD, Chronic disease; FHO, Femoral head and neck ostectomy; Significantly different; * P <0.05; ** P <0.01; *** P <0.001; SS, Statistical significant*

DISCUSSION

Coxo-femoral diseases (CFD) are very common in dogs and cats [5]. The surgery was carried out for treatment of CFD [5]. The common surgical procedure for CFDS treatment is femoral head and neck resection [5,9]. Excision athroplasty of coxo-femoral joint be the appropriate, simple and inexpensive technique with the omission of bone-bone contact in patients with hip dysplasia, DJD, morbond-legg-calve-perthes disease, fracture of head and neck of femur or acetabulum, coxo-femoral luxation and failed total hip replacement procedures [1,10-14]. Some factors such as weight, history, age and post-operative care could affect the outcome of excision arthroplasty. In present study, it has been evaluated the role of each factor and their relationship with each other intra group and among groups. We have found that DJD had correlation with outcome, but weight had no correlation with the outcome of group I *(Table 5)*. Latter finding was in agreement with the results of Off and Matis [15]. Therefore in group I, arthritis (pre-operative lameness and its duration due to DJD had correlation with the results of Off and Matis [15].

In group II, weight and DJD had no effect on the outcome. In fact, in these dogs, the outcome was favorable *(Table 6)*. There are few data about the role of the latter factor in prognosis in veterinary literature, hence authors of the study presume that volume mass, strength of muscle, body condition, anisotropic characteristic of bone

and supportive structure peripheral of joint, and maturity are the probable reasons of better outcome similar to human literature in young and aged patients in comparison with group II. Investigators reported that the patient with muscle atrophy was slower to return to function than the patients with acute lameness that supports our recent findings. In the other hand, age had an effective role on group II. This finding was not in agreement with the results of other investigation. The outcome was reported favorable (96%) by subjective owner's evaluation such as duration of preoperative signs, postoperative convalescence, weight bearing on the affected limb at slow and fast and strenuous exercise during cold or wet weather, and finally subjective assessment of the patient. These findings were not supported by results of objective clinical data. Off and Matis reported that the outcome of FHO was favorable and age and weight had no determinant role [15]. In group III (elder dogs), our findings showed that body weight had no correlation with the outcome but DJD had correlation with outcome *(Table 7)*. There is little difference between group I and group III statistically, so we found less statistical correlation between the body weight and the outcome in dogs less than 10kg in group I *(Table 5)* in comparison to the ones over 10 kg in the same group *(Table 5)* and vice versa of group III. In group III, it is presumed that hyperactivity of toy breeds even in aged patients in comparison to the large dog is likely to play a noticeable role and could support our findings about DJD and its effect on the outcome. Some investigations indicated that good return to active limb function after FHO depends on whether the length of time the pathologic hip joint condition is present and on also the severity of the degenerative changes. In majority of the studies, it has been pointed that weight is a key and risk factor in prognosis [5,16] but other study revealed that there was no correlation between body weight and functional outcome statistically [15]. Our study also indicated weight has no effect on the outcome of group II and is effective in both lower and the ending ranges. It is obvious clear that weight increases the load placed on the pseudo joints and recurrence is expected and weight is a clear risk factor for prognosis after FHO [17,18]. Investigation showed that dogs lighter than 10 kg have a good to excellent prognosis, when compared to heavier dogs [3] and population-based study has consistently shown a link between the age or weight or DJD and prognosis after FHO [3].

The present clinical study revealed that weight and DJD were not the influential factors in the prognosis of 1 to 5 year old dogs, but there was an statistical association between the age and DJD with the outcome, so the outcome in younger and elder dogs were not as good as dogs between 1 to 5 years. Therefore, regardless of the subjective data analyzed, authors showed that age would have an effective role on the outcome and weight is not as important as age in this regard. The present study suggests the need for further identification and elucidation of physiologic and pathophysiologic risk factors influencing the prognosis.

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