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Clinical and Radiological Evaluation of Modified DARthroplasty using Rib Allograft Impregnated with the Mesenchymal Cells and PRP in Dogs

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Abstract

BACKGROUND: Hip Dysplasia is a frequent orthopedic disease that is characterized by early joint sublux-ation. The DARthroplasty technique is a two-part process that involves applying bone graft to increase the femoral head coverage with a low morbidity rate and the long term is known results.

OBJECTIVES: This study was aimed to investigate the radiographic and clinical changes after transplanting the rib allograft impregnated with PRP and MSCs in the treatment of hip dysplasia in a dog. The current study was conducted to assess the effectiveness of modified DARthroplasty.

METHODS: 12 dogs were selected, all of them operated by the modified induced hip dysplasia. Afterward, an approximately 25 mm segment rib was harvested and transplanted at slot approximately 7 mm broad and 12.5 mm high, close craniodorsally to the joint capsule origin, and secured with a 2 mm cortical bone screw in each recipient dog. PRP and MSCs were injected into the gap around allograft. Subsequently, they were divided into 3 subgroups of 4 dogs in each group, control, PRP, and MSCs. 6 months after the surgery, all dogs were subjected to clinical and radiographic evaluations.

RESULTS: Clinically, all dogs showed no sign of orthopedic disorder which was determined by Ortolani sign, and no muscle atrophy and pain were elicited in the hip joint. One dog showed a slight lameness degree about two weeks and one case had seroma but was immediately treated by aspiration and pressure bandage. Upon ra-diographic examination, no dislocation of the rib allograft could be detected. Bone proliferation was observed. Dogs in all groups showed NA and PC increase with MSCs (5.25 ± 0.3 and 22.5 ± 0.81), PRP group (6.5 ± 0.43 and 20.5 ± 0.12) and control group (6.5 ± 0.35 and 19 ± 1.23) at six months postoperatively.

CONCLUSIONS: This study showed that rib bone allograft with PRP and MSCs can be quite effective on joint congruency and stability in symptomatic dogs due to hip dysplasia.

KEYWORDS: DARthroplasty, Hip dysplasia, Mesenchymal stem cells, PRP, Radiology

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Introduction

Hip dysplasia is an impaired development of the hip joint characterized by subluxation or complete luxation of joint with subsequent mild to severe degenerative changes manifested by pain and lameness (Tomlinson and Cook, 2002). The incidence of hip dysplasia is highest in large and giant breeds and has increased in the past 50 years which is a concern for dog owners, dog breeders, and veterinarians (Comhire and Snaps, 2008; Smith, 1998). While the definitive diagnosis of hip dysplasia must be based on the radiograph, other screening methods include clinical signs, palpation, ultrasound, computed tomography, and magnetic resonance imaging (Flückiger, 2008; Ginja et al., 2009; Butler and Gambino, 2017). Treatment options of hip dysplasia range from conservative (administration of nonsteroidal anti-inflammatory drugs, chondroprotective drugs, weight maintenance, exercise moderation, complete rest, dietary changes, physical therapy, confining to restricted cages, nutraceuticals, acupuncture, and stem-cell therapy) to surgery (Marx et al., 2014; Vilar et al., 2014; Dycus et al., 2017; Corral, 2018). The surgical options can be divided into two groups, depending on the animal's age: (1) therapies aimed at alleviating pain consist of total hip replacement, femoral head, and neck ostectomy, pectineal myectomy, coxofemoral denervation and (2) therapies aimed at preventing or lessening the amount of future degenerative joint disease(DJD) include juvenile pubic symphysiodesis, triple pelvic osteotomy, double pelvic osteotomy, femoral neck lengthening, intertrochanteric osteotomy and DARthroplasty (Moses, 2000; Denny et al., 2018; Witte, 2019). DARthroplasty directly increases the size of the acetabulum by promoting the coverage of the femoral head through implanting graft bone to the lateral rim (Slocum, 1998; Jacobs et al.; 2004, Grzegorzewski et al., 2013). DARthroplasty is a relatively new center of attention procedure for the prevention of early detrimental effects of luxation on joint elements (Yaprakci et al., 2014). Also, it has not been performed long enough to collect results from a large number of patients and there are no short- or long-term scientific studies documenting the effectiveness of DARthroplasty in the treatment of canine hip dysplasia (Luck, 2007). Mesenchymal stem cells (MSCs) are multipotential cells that can differentiate into osteoblasts, chondrocytes, stromal cells, adipocytes, fibrous tissue, myoblasts, tenocytes and become more commonly utilized to promote bone graft fusion rate (Anderson et al., 2013, Lee et al., 2011). Platelet-rich plasma (PRP) containing many growth factors such as transforming growth factor-β, platelet-derived growth factor and insulin-like growth factor that are involved in bone healing and tissue repair and also as an augmentation procedure to improve implant healing (Roffi et al., 2013, Jensen et al., 2005). This study aims to report the use of allograft bone impregnated with mesenchymal stem cells derived from bone marrow and platelet-rich plasma in canine DARtroplasty and to retrospectively evaluate the clinical and radiographic outcome after a 6-month follow-up.

Materials and Methods

In this study, twelve neutered adult male mongrel dogs, weighing ~ 22.5 ± 2.5 kg, were provided at 12 months of age by the University of Tehran (Tehran, Tehran Province, Iran). All experimental procedures involving animals were conducted accord-

ing to the Ethical Principles in Animal Experiments adopted by Faculty of Veterinary Medicine Research Committee and were approved by the Experts Research Committee in Faculty of Veterinary Medicine University of Tehran, Protocol 2345/95/2016. Firstly, animals received vaccination and they were wormed and castrated. After, the dogs underwent a radiographic and physical and orthopedic examination to obtain baseline information. Secondly, while coxofemoral luxation and hip osteoarthritis models have been previously described (Ozaydin et al, 2003, Little et al., 2016), a modified model of coxofemoral subluxation to induction of hip dysplasia was provided by capsulotomy, ligament capitis osis femoris transaction and capsulorrhaphy with craniolateral approach (Figure 1, A). Dogs were assessed to be at-risk for CHD by evidence of hip laxity, which was defined as orthopedic examination and radiographs.

All dogs were subsequently divided into 3 groups of four dogs each: Control (acetabular coverage with allograft), PRP (acetabulum was covered by allograft impregnated with PRP), and MSCs group (covered acetabular with allograft and MSCs).

Surgical technique

Modified DARthroplasty was carried out on all dogs. Animals were taken off-feed for 12 h and water was withheld for 2 h. All research dogs were premedicated with a Ketamine (10 mg/kg, IM, Alfasan, Netherlands) and Xylazine (0.5 mg/kg, IM, Alfasan, Netherlands) and afterward the left coxofemoral area was thoroughly clipped. After receiving a prophylactic dose of Cefazolin (22 mg/kg, IV, Exir, Iran), anesthesia was inducted by a combination of Ketamine (5 mg/kg, IV) and Diazepam (0.25 mg/kg, IV, Caspian Tamin, Iran). Following endotracheal intubation, inhalation anesthesia was maintained with 2% Isoflurane in Oxygen via a rebreathing circuit. Animals were positioned in left lateral recumbency, then thorax and left coxofemoral region were aseptically prepared for the surgery with betadine and alcohol. After routinely reaching the hip joint with a dorsal approach, an arch-shaped slot, approximately 7 mm broad and 12.5 mm high, was created close dorsally to the joint capsule origin into the subchondral bone from the cranial end in anterior direction using a high speed round burr. An appropriate 2 mm cortical bone screw was selected based on measurement by depth gauge and radiograph. After adjustment, the rib allograft was firmly packed into the slot and secured to the recipient bed with screw in a lag fashion in such a way as to cover the posteriolateral aspect of the femoral head and to rest on the capsule (Figure 1, B). The motion of the hip was checked to find out whether the graft did not restrict its full range, and where necessary the graft was made smaller. The next step included meticulous reinsertion of gluteal muscles and closure of the wound routinely.

Allograft collection

Before the beginning of primary surgery, standard lateral approach to the right thorax on the area of greatest convexity was applied to harvest an approximately 25 mm segment of the 8th left rib, which was wrapped in sterile saline (0.9% NaCl) solution soaked gauze sponge to be transplanted in a recipient dog which was prepared simultaneously. (Aranda et al., 2008; Boudrieau et al., 2004; Makridis et al., 2012).

PRP preparation

For obtaining autologous PRP, before each operation, peripheral venous blood was drawn into tubes containing an anticoagulant (ACD) under standard aseptic technique.

The four 10 ml ACD tubes were filled for each of the four dogs in the second group and immediately transferred to the laboratory. Blood samples were centrifuged (Smart-PReP2, Centrifuge, Harvest Plymouth .MA) for 5 min at 1000 g so that its three components (Erythrocytes, buffy coat, and platelet-poor plasma) were formed based on the density of blood components. The buffy coat layer was closely collected by a pipette and pooled in a separate tube which was spun for a second time for 15 min at 1500 g so that the PRP portion was taken from the surface, 3 ml of PRP mixed with calcium chloride solution was obtained. Four syringes containing PRP were delivered to operation room so that a volume of 3 ml of PRP containing 882±199×103 plate¬let/µl was utilized around allograft site for each dog (Bearden et al., 2017; Lee et al., 2014; Messora et al., 2014; Shin et al., 2017; Dallari et al., 2016; Aldirawi et al., 2018).

Bone marrow MSCs isolation

Under strict aseptic condition bone marrow was obtained from the iliac wing of dogs three weeks before transplantation surgeries. Under anesthesia and using a Jamshidi bone marrow needle (15G), 9 mL bone marrow was aspirated into a syringe containing 1mL heparinized saline solution. Immediately specimens were sent to the cell-culture facility. The BM-heparin blood was diluted at a 1:1 ratio with Dulbecco's modified Eagle's medium (DMEM; Gibco, USA) high glucose and carefully laid over the 3 ml Lymphosep density gradient medium (Biowest, France) in a 15 ml conical tube and then centrifuged for 30 min at 400 ×g. The mononuclear cell layer at the plasma-Ficoll interface was removed and resuspended in DMEM and finally centrifuged at 400 gr for 10 min twice. The mononuclear cells were plated in tissue culture flasks at a density of 1×105 cells per 25 cm^2 10% fetal bovine serum (FBS; Gibco, USA), 1000 IU/ml penicillin, and 100 µg/ml streptomycin were added to culture flasks and incubated at 37°C with 5% CO2 and 95% air at 100% humidity. Four days after the initial culture, plates were washed with Dulbecco's Phosphate Buffered Saline (DPBS) to remove the nonadherent cell. From this point on, every 2nd day, we changed the medium until a confluence of 70-80% was achieved. The BMSCs, adherent cells, were harvested with 0.25% trypsin-EDTA and subcultured until at passage 3 they were used in the third group. MSCs were injected into the gap around allograft in specific dogs from which they had been collected. (Callegaro et al., 2018; Bearden et al., 2017; Jo et al., 2017; Long et al., 2013; Rafatpanah et al., 2018; Grabowski and Robertson, 2013; Mirghasemi et al., 2017; Thua et al., 2015).

Post–operative care

Radiographs were taken immediately after the surgical procedure to be assessed as the baseline date for comparative purposes with follow-up radiograph examinations at 6 months. After recovery from general anesthesia, the dogs were transferred to their respective cages. Cefazolin (22.5 mg/kg, IV), was administered every 12 h for five days and Tramadol (2 mg/kg q12h, Alborz Darou, Iran) was given for 3 days and changed to oral Tramadol (4 mg/kg q12h, Alborz Darou, Iran) for 5 days. Skin sutures were removed within 14 days. The orthopedic examination was conducted at 2 months and 6 months postoperatively also neurological examinations were performed to exclude conditions other than a hip disorder.

Evaluation

Ventrodorsal hip_extended radiographs were used to calculate Norberg angle and estimate femoral head coverage using the

scoring system developed by the Orthopedic Foundation for Animals (OFA) via an MX-20 Cabinet X-ray System (35 kV, 300 µA and 240 s) under sedation (IM Ketamine (10 mg/kg) and Xylazine (0.5 mg/kg) and afterward an IV cocktail of Ketamine (5 mg/kg) and Diazepam (0.25 mg/kg)). The radiograph image was used for diagnosis, DJD score (0-4), Norberg angle (NA), percent coverage (PG) of the femoral head by acetabulum, graft position, metallosis around screws, bone proliferation associated with the graft. The Clinical variables evaluated include Ortolani maneuver, gait observation for gross lameness score (an abnormality of gait or posture), muscle atrophy (decrease in mass of muscle), the hip extension to detect pain with passive movement and range of motion, presence of seroma (Off and Matis, 2010; Dueland et al., 2010). DJD also is known as osteoarthritis, was defined as a noninflammatory, noninfectious degeneration of articular cartilage characterized by bone formation at the synovial margins and by fibrosis of periarticular soft tissue. Norberg angle (NA) was characterized as the relationship of the center of the femoral head to the craniolateral aspect of the dorsal acetabular rim, a NA of 105o or greater has been considered to indicate normal status. Percent Coverage is an indication of the support provided by the acetabulum to oppose the force transmitted from the femur, a PC of 50% or greater was normal status (Figure 1, C). Ortolani sign was defined as the "clunk" or shift palpated as the femoral head enters the acetabulum during the abduction of the hip.

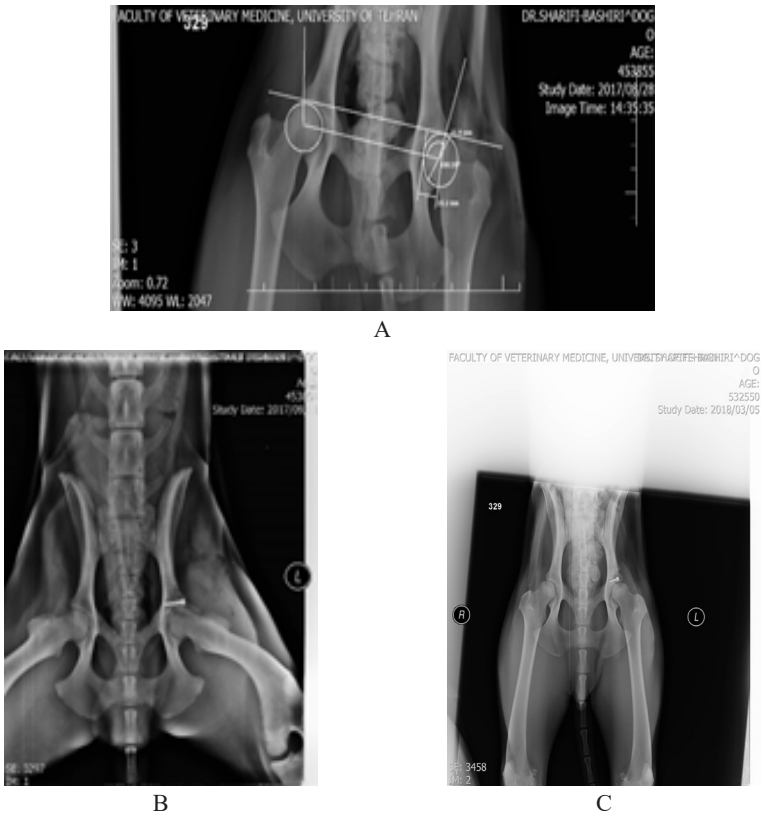

Figure 1. Radiographic images show (A) a hip subluxation following the modified induced coxofemoral subluxation procedure which is measured by NA and PC parameters in a standard ventrodorsal projection and (B) after a modified DARthroplasty, the femoral head was completely covered with the rib allograft. (C) An illustration of periosteal reaction and allograft remodeling on the radiograph and indicates the amount of acetabular coverage.

Table 1. Clinical tests performed, time tested and percentage of the dogs tested.

		Control		PRP		MSC	
		Before Surgery	After Surgery	Before Surgery	After surgery	Before Surgery	After Surgery
Ortolani Sign							
Negative	0						
Positive	1	(100%)4	(100%)4	(100%)4	(100%) 4	(100%)4	(100%)4
Lameness							
None	0						
Slight	1						
Mild	2	(50%)2	(75%)3				
Moderate	3	(25%)1	(25%)1	(50%)2	(100%)4	(75%)3	(100%)4
Severe or intermittent non-weight-bearing	4	(25%)1		(50%)2		(25%)1	
Non-weight-bearing most of the time	5						
Musculature (hip and thigh (regions							
Normal	0						
Some atrophy	1	(100%)4	(100%)4	(100%)4	(100%)4	(100%)4	(100%)4
Marked atrophy	2						
(Pain (on the hip extension							
None	0	(25%)1		(25%)1			
Mild to moderate (turning or (pulling on the limb	1	(75%)3	(100%)4	(75%)3	(100%)4	(50%)2	(100%)4
Severe (vocalisation or aggres-(sion	2					(50%)2	
Seroma							
None	0	(100%)4	(75%)3	(100%)4	(100%)4	(100%)4	(100%)4
A little	1		(25%)1				
A lot	2						

Results

The authors have performed the DARthroplasty with rib allograft on 12 hips. All dogs completed the study without major complications. According to the same clinical results that have been obtained at 3 months and 6 months after surgery and the absence radiographs between post-op and 6 months, the comparison was mentioned between preoperative and by next six months. In the control group, one graft was fixed using two screws that did not present a significant dif-

Table 2. NA and PC study showing means and standard errors in control, PRP , and MSC groups before and after 6 months of grafting.

	Control		PRP		MSCs	
	NA	PC	NA	PC	NA	PC
Before Surgery	101.25±1.29	40.25±2.04	101.75±1.39	41.75±2.16	103.25±0.82	43.75±1.47
After Surgery	107.75±1.64	59.25±3.27	108.25±1.82	62.5±2.28	108.5±1.12	66.25±2.28

ference in that final result compared with the other dogs. All dogs that showed positive Ortolani sign before surgery was converted to a negative after surgery. Eleven dogs had no apparent lameness at 6 months, whereas the other one had some lameness for approximately 2 weeks due to soft tissue injury in the control group. After the third week, all dogs had a subjectively normal gait. Postoperative re-evaluation indicated that all dogs had normal range of motion without pain during passive movement of the limb. Muscle atrophy did not occur after surgery (Table 1). In the PRP group, one early patient had a little seroma, which was due to loose muscle closure. This responded well to aspiration without any sign of infection. In the MSCs group, one graft appeared slightly cranial to its expected location but fortunately, it was considered enough to cover the femoral head. None of the dogs revealed any DJD and metallosis findings radiographically. No dislocation of the allograft was observed in any of the dogs until to be remodeled (Fig. 1, C). The mean ± SD value of the preoperative NA was 101.25 ± 1.29 (range, 100o to 103o; median 101o), 101.75 ± 1.39 (range, 100o to 104o; median 101.5o) and 103.25 ± 0.82 (range, 102o to 104o; median 103.5o) for control, PRP and MSCs, respectively. After surgery, the mean ± SD of the same parameter increased to 107.75 ± 1.64 (range, 105o to 109o; median 108.50), 108.25 ± 1.82 (range, 107o to 109o; median 108.5o) and 108.5 ± 1.12 (range, 107o to 110o; median 108.5o). In the control group, the PC values were 40.25% ± 2.04% (range, 37% to 42%; median 41%) and 59.25% ± 3.27% (range, 55% to 64%; median 59) before and after surgery, respectively, and this increase was elicited in the PRP 40.25 ± 2.04% (range, 39% to 45%; median 41.5%) and 62.5% ± 2.28% (range, 60% to 62%; median 61) pre and post-operation, respectively. The PC surged from 43.75 ± 1.47% (range, 42% to 46%; median 43.5%) to 66.25% ± 2.28% (range, 64% to 70%; median 68) postoperatively in MSCs group (Table 2). Bone proliferation was noted at the cranial aspect of the implant in all recipient dogs.

Discussion

DARthroplasy is a surgical intervention intended to improve the biomechanics of the hip, hip joint congruity, decrease abnormal hip joint laxity, normalize articular stresses and reduce hip pain. It can be performed bilaterally and done with routine bone instruments with a minimal fixation for a reasonable cost compared to other procedures (Witte, 2019). Dogs clinically affected by hip dysplasia with palpable or radiographic joint laxity before articular cartilage is badly damaged, are candidates for this procedure (Hupp et al., 2007). DARthroplasy is also a viable surgical option for dogs in

which juvenile pubic symphysiodesis, triple pelvic osteotomy, and total hip replacement are precluded by cost, age, degree of laxity. This technique is an advanced procedure and should be performed only by expert surgeons and contraindicated when there are signs of advanced DJD, breakdown of the dorsal acetabular rim, or neurological disease. Early reports indicated that the animals with significant DJD but without instability are not considered candidates for it, because the function of this procedure is to improve stability. This procedure results in an excellent return to normal function unless complications occur. Although temporary sciatic neuropraxia, screw breakage, infection and seroma have been reported as complications secondary to biocompatible osteoconductive polymer shelf arthroplasty, in our study none of them occurred postoperatively other than seroma in one case which responded to aspiration and pressure bandage. In this case, appropriate muscle suturing and dead space obliteration could have been useful to prevent seroma formation. To support our theory as to whether the modified procedure could lead to radiographic improvement of congruency and hip stability, NA and PC were analyzed before and after surgery, and the results of our analysis demonstrated a remarkable increase of NA and PC for hips and a subsequent decrease of subluxation and joint incongruency in all groups. Since both positive Ortolani incidence and NA and PC in dogs had improved significantly at six months, our study demonstrated coxofemoral stability occurs following modified DARthroplasty. Bone proliferation has been reported at the cranial of an implant on ilial wing and neck 17 weeks after surgery which was observed in our radiograph evaluation indicating an active ossification site. In Slocum's series of cases, none of the patients that have undergone DARthroplasty have demonstrated painful signs, which was already evident in our study. In our study, the autologous bone graft was not applied since it is already known that it is the most effective bone substitute due to the presence of osteoprogenitor cells inside the graft that are reported to survive after transplantation (Kruyt et al., 2004) and it cannot be further enhanced by the addition of adjuvant factors, because of the presence of differentiated osteoblasts (Ronald et al., 2004). Although from a clinical point of view, a combination of bone allografts with ostegenetic factors is of great relevance, in the current study was radiologically observed the reliable bone healing at all groups, however, in PRP and MSCs groups the appreciable bone healing and remodeling were discerned. This result was probably because radiographs were taken only one time at 6 months postoperatively. The absence of growth factors and multipotent MSCs from the periosteum and bone marrow causes bone allograft fracture and nonunion (Jensen et al., 2004, Long et al., 2013). The use of MSCs and PRP had no adverse events and post-op complications clinically so MSCs or PRP impregnated allograft is a viable alternative if a dog needs bone grafting. In our experiment, the local injections of MSCs and PRP seem to have good clinical efficacy in distraction osteogenesis, however, further investigations are needed. Shelf arthroplasty (or biocompatible orthopedic polymer shelf arthroplasty) was reported by Sertl and Jensen in the late 1980s as a new surgical treatment for the canine hip. In the procedure, for extending the dysplastic lateral rim on the acetabulum, a commercial polymer as a bony shelf was used (Sertl and Jensen, 1990). Although this

procedure provided a high rate of successful functional recovery, hip dysplasia may progress after surgery since BOP material failed to be osteoconductive, despite the positive early anecdotal reports. Therefore, it can no longer be advised for hip dysplasia treatment in young dogs. After 27 years, dorsal acetabular rim arthroplasty, or DARthroplasty, has been described in which strips of corticocancellous bone from the ipsilateral ilial wing as an autograft are placed in a slot above the hip joint capsule origin (Hupp et al., 2007; Luck, 2007). To date, a few published reports of clinical results are available to accurately determine indications, effectiveness, and prognosis of shelf arthroplasties or DARthroplasty other than human medicine with numerous descriptions and variations. At present, only Slocum's description of technique and results are available in veterinary medical publications (Slocum et al., 1998). The modified DARthroplasty technique deserves to be thoroughly investigated as a surgical option for canine hip dysplasia and subluxation treatment. However, a long-term func¬tional analysis using larger animal models is required to prove it. Also, future studies on a more definitive method to evaluate osseous integration and histologic examination to further qualify the degree of bony fusion of the grafts and recipient beds is necessary.

Conclusion

The current study indicates that rib bone allograft with PRP and MSCs increases the augmentation of the dorsal acetabular rim to promote the biological remodeling of the femoral head within the acetabulum. It results in a favorable clinical function of the hip and a good outcome. Moreover, this procedure helps to reduce the subluxation of the femoral head, thereby helping to restore the biomechanical function of the hip joint. However, we believe that more high-quality studies with follow-up are needed before recommending the modified DARthroplasty procedure as an equal surgical alternative to Shelf arthroplasty.

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Conflict of Interest

The authors declared that there is no conflict of interest.

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مجله طب دامی ایران، ۱۳۹۹، دوره ۱۴، شماره ۲، ۱۳۳-۱۲۱

ارزیابی بالینی و رادیوگرافی آرتروپلاستی سقف استابلوم تغییر یافته بافت پیوندشده دنده پوشش داده شده با سلول‌های مزانشیمی وپلاسمای غنی از پلاکت در سگ

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چکیده

زمینه مطالعه: دیسپلازی لگن یکی از بیمارهای متداول ارتوپدی است که به همراه دررفتگی مفصل به وقوع می‌پیوندد. روش آرتروپلاستی سقف استابلوم دو مرحله‌ای می‌باشد و بر اساس آن گرفت استخوانی برای افزایش پوشش سر استخوان ران به کار می‌رود که مطالعات کمی بروی آن انجام شد و متعاقباً نتایج بلند مدت و میزان به‌کارگیری کمی دارد.

هـــدف: هدف از مطالعه حاضر، ارزیابی تغییرات رادیواگرافی و بالینی بعد از پیوند شدن بافت دنده پوشش داده شده با یا بدون سلول‌های مزانشیمی و پلاسمای غنی از پلاکت در درمان دیسپلازی لگن در سگ. در این مطالعه میزان اثرگذاری آرتروپلاستی سقف استابلوم تغییر یافته مورد بررسی قرار می‌گیرد.

روش کار: ۱۲ سگ انتخاب شد و همه آن‌ها در ابتدا تحت عمل جراحی القای دیسپلازی اصلاح شده قرار گرفتند. سپس یک قطعه ۲۵ میلی‌متری از دنده استخراج شد و در یک حفره تقریبا با پهنای ۷ میلی‌متری و عمق ۱۲/۵ میلی‌متری در بالا و جلو منشأ کپسول مفصلی مفصل لگنی رانی بوسیله پیچ ۲ میلی‌متری کورتیکال به هر سگ پیوند شد. پلاسمای غنی از پلاکت و سلول‌های بنیادی مزانشیمی به محل پیوند تزریق شد. متعاقباً حیوانات در سه گروه چهارتایی قرار داده شدند: گروه کنترل، گروه پلاسمای غنی از پلاکت و گروه سلول‌های بنیادی مزانشیمی. ۶ ماه پس از جراحی، همه سگ‌ها مورد ارزیابی بالینی و رادیولوژی قرار گرفتند.

نتایج: از لحاظ بالینی هیچکدام از سگ‌ها اختلال ارتوپدی که با علامت اورتولانی مشخص می‌شود، مشاهده نشد همچنین کاهش حجم عضلات و درد در مفصل لگنی رانی نشان داده نشد. در یکی از سگ‌ها لنگش خفیف به مدت دو هفته دیده شد و در یک مورد دیگر سروما تشکیل شد که با کشدن محتوای آن و بانداژ فشاری درمان شد. در ارزیابی رادیوگرافی هیچ علامت جابه‌جایی دنده مشاهده نشد. پرولیفراسیون استخوانی مشاهده شد. سگ‌ها در در تمامی گروه‌ها افزایش زاویه نوربرگ و درصد پوشش داده شده سر استخوان ران برای گروه سلول‌های مزانشیمی مغز استخوان (۵/۲۵±۰/۳ و ۵/۲۲±۰/۸۱)، برای گروه پلاسمای غنی از پلاکت (۶/۵±۰/۴۳ و ۲۰/۵±۰/۱۲) و کنترل (۶/۵±۰/۳ و ۱۹±۱/۲۳) در شش ماه پس از عمل نشان داده شد.

نتیجه گیری نهایی: نتایج این مطالعه نشان می‌دهد که بافت پیوند شده دنده پوشش داده شده با سلول‌های مزانشیمی و پلاسمای غنی از پلاکت می‌تواند کاملاً در یکپارچگی و استحکام مفصل در سگ‌های با علائم دیسپلازی مفصل لگنی رانی مؤثر باشد.

واژه‌های کلیدی:

آرتروپلاستی سقف استابلوم، دیسپلازی مفصل، سلول‌های مزانشیمی، پلاسمای غنی از پلاکت، رادیولوژی.

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