

Post-Operative Management of Unilateral Coxofemoral Excision Arthroplasty

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Background

A coxofemoral excision arthroplasty involves the surgical removal of the femoral head and neck.^{19, 25} It is a salvage procedure with the goal to eliminate bone to bone contact at the hip and results in the formation of a functional pseudarthrosis (a scar tissue joint).^{19, 25} It was first described as a treatment for dogs with hip dysplasia in 1961.^{21, 24} This surgical option is indicated in cases of canine hip dysplasia, Legg-Calve-Perthés disease, non-reparable fractures of the acetabulum or femoral head, osteoarthritis, chronic recurrent hip luxations, osteomyelitis and septic arthritis, failed total hip replacement or villinodular synovitis of the hip joint.^{5, 19, 25}

There are factors to be considered in both patient selection and in post-operative function with a femoral head and neck excision (FHNE):

- a) Body size: Dogs less than 22kg have good to excellent results, where-as larger dogs may be less active post-operatively.^{19, 25} However, FHNE surgeries have been successfully performed in equine, bovine and ursus species.^{25, 26}
- b) Patient temperament: active dogs tend to recover faster than those who are sedentary, overweight or unable to adapt.²⁵
- c) Patient age: younger dogs, in good body conditions tend to become functional faster.^{19, 25}
- d) Obesity: Overweight dogs have ore difficulty in their rehabilitation period.²⁵
- e) Chronicity: Animals that have suffered with long-standing hip pain will already have disuse muscle atrophy to the affected limb and may require more extensive post-operative physical therapy.²⁵
- f) Concurrent musculoskeletal problems: Other neurological or orthopaedic issues may slow or compromise the recovery and weight bearing.^{19, 25}
- g) Bilateral considerations: The ideal patient has one functional hind limb²⁵, however successful bilateral FHNE surgeries have been described in 15 dogs²² and one case of one dog that underwent a FHNE following a contralateral hind limb amputation.³

The procedure itself is described as follows.²⁵ Usually a craniolateral approach if undertaken and a partial tenotomy of the insertion of the deep gluteal is made. An incision of the joint capsule must be made and severance of the ligament of the femoral head is performed if it is still intact. Elevation of muscle fibres is done with periosteal elevators. The limb is then rotated outwards 90 degrees to allow for exposure and for accurate osteotomy angulation. Care needs to be taken both in utilizing retractors so as to not cause injury to the sciatic nerve on or around the biceps femoris as well as in inspecting the osteotomy site to ensure that the site is smooth and no portion of the neck is left in. As a matter of preference, some surgeons may prefer to suture the joint capsule and/or to create an interposition of soft tissue between the femur and acetabulum. The number one reason for poor outcomes is leaving in a portion of the femoral neck and the resultant bone on bone contact.

Post Operative Care

Physical therapy should be started the day after surgery, and incorporate range of motion (ROM) into flexion, extension and abduction.²⁵ Aggressive analgesic therapy may assist in early ambulation and rapid return to normal function.¹⁹ As well, use of therapeutic modalities can aid in pain relief and soft tissue healing and hence improved functioning.^{17,20}

However, cases that are not referred for physiotherapy immediately post-op may exhibit severe loss of range of motion and muscle wastage depending on the length of delay before obtaining these services. The goals in treating these cases are to maximize weight bearing, gain ROM or muscle extensibility, strengthen the affected limb, stimulate soft tissue healing, provide pain relief following an aggressive physiotherapy stretching or exercise treatment session, and address proprioception deficits.

Facilitation of Weight bearing

It is imperative that the animal actually use the post-operative limb, so any safe exercise that encourage limb use can be utilized. Various therapeutic exercise techniques have been described to stimulate weight bearing on any post-operative limb. These exercises include (but are not limited to):

- a) Cross Leg Standing: Lift the good hind leg and its opposite front limb off the ground, allowing the dog to balance on the remaining two legs. Hold up for 10 – 15 seconds or as tolerated (shorter or longer).⁴
- b) Booties / Plastic Bag / Hair Elastics: Booties, a plastic bag or a hair elastics can be used on the unaffected limb to promote a weight shift onto the affected limb – dogs or cats will often lift and shake the ‘bootie’ foot, which again increases stance phase on the affected leg.⁴ A variation of this technique has also been described whereby a noxious stimuli (such as a syringe cap, rock or pen cap) is applied to the un-affected limb to achieve the same effect.^{1, 6, 10}
- c) Hill Walking: Up hill walking may facilitate hind limb weight bearing as well as extension in the hip.^{4, 7}
- d) Dancing: Lift the dog’s forelimbs off the ground. Just hold this position or allow the animal to step forwards or backwards.^{1, 4, 7}
- e) Slow leash walking: As walking is a 4-beat gait, controlled walk at a heel position may be beneficial.^{8, 16}

Gain Range of Motion

Regaining hip extension is a one of the most important goals when rehabilitating this type patient.¹⁶ Passive range of motion (PROM) may help to regain extension, however an animal that has been avoiding this movement may need to be tricked into extending its hips. To accomplish this goal the physiotherapist could try exercises such as the following:

- a) Standing with front legs up on a higher surface such as step 2 or 3 of a set of stairs, or at counter top or stool.
- b) Holding the animal off the ground in an upright vertical position while allowing the animal’s hind paws to be in contact with the ground.
- c) Gently push on the cranial surface of the dog’s thigh while rubbing the dog’s tummy.

Strengthening

Atrophy of the hind limb muscle mass should be addressed post-operatively.¹⁶ Various treatment techniques can be used to strengthen the muscles of the hip and thigh. Exercises to accomplish this goal can include:

- a) The underwater treadmill used at slow speeds to encourage weight bearing and hence muscle strengthening.¹⁶
- b) Up hill walking may function to shift weight further back onto the hind limbs.
- c) Diagonal limb standing would be accomplished by lifting the unaffected hind limb and its opposite forelimb off the ground to facilitate static weight bearing on the surgical limb.⁷
- d) Sit to stand practice may strengthen the antigravity muscles of the surgical limb.¹⁰

Pain relief and soft tissue healing

The FHNE surgery may have resulted in adhesions to the distal muscle secondary to tracking of blood from the surgical site and soft tissue damage done at the same time. As well, the techniques listed above may result in mild soft tissue soreness. Therapies that may address this could include modalities and/or massage.

It is well known that healing of soft tissue structures can be accomplished with ultrasound, LASER, or pulsed electromagnetic field therapy.^{9, 17, 20, 23} The tissues surrounding the hip joint as well as the quadriceps and sartorius muscle may benefit from these treatments in regards to the surgically induced trauma.

Non-noxious sensory stimuli reduces blood pressure, changes secretion of cortico-trophin-releasing hormone and increases pain thresholds in rats.¹³ In humans, it produces pain relief and increase the plasma concentration of B-endorphins.¹³ All of these effects could provide comfort to the animal, hence encouraging use and relieving post-exercise discomfort.

Proprioceptive retraining

As the limb begins to heal and the dog is utilizing it consistently in gait, the next goal should be to retrain proprioception of the affected leg.¹⁵ Proprioception is the mind's awareness of the where the body is in space.¹⁵ Several exercises have been described to address co-ordination and muscular control of a limb. Some suggestions for proprioceptive retraining include:

- a) Walking over obstacles or cavaletti rails requires co-ordination, muscular timing and body awareness.^{7, 27}
- b) A wobble board can be utilized best in this scenario by placing the dog's forelimbs on the board while leaving the hind legs static on the ground as the board is wobbled by the therapist. This creates a balancing exercise for the hind limbs.
- c) Walking on different surfaces (on foam, in sand, in tall grass, on uneven ground, in shallow water or in the woods) requires a responsive musculoskeletal system.^{4, 7}
- d) Standing on or walking across a narrow plank of wood raised slightly off the ground is beneficial for advanced coordination training.

Progression of therapy

All patients will recover and recuperate at different rates, whether human or animal. For this reason, it is imperative that the physiotherapist evaluate the animal at the beginning and throughout each therapy session in order to ascertain the animals present capabilities and therapeutic needs in order to capitalize on each therapy session and progress the rehabilitation program accordingly. Advanced strengthening and proprioceptive retraining are required. As the animal begins to use the limb consistently and has built up some muscle bulk, exercises of greater difficulty should be prescribed. Jumping up onto the bed or a platform, pulling exercises (using a pulling harness), or gradually increasing the duration, distance or intensity of exercise (walking or trotting) might further strengthen the limb. As well, use of agility-type exercises should be incorporated into therapy if the animal is very active and expected return to an active lifestyle. Graduation to dynamic exercise retraining is required, and may incorporate jumping then recall exercises, retrieving exercises, playing games of chase or keep away, or short sprinting exercises can enhance athleticism and provide end-stage rehabilitation.²⁷

In scenarios where the animal and possibly the owner as well are far less physically active or motivated, the physiotherapist should advise on weight management, adoption of a healthy lifestyle (need for walks) and nutraceutical supplementation (i.e. glucosamine, and essential fatty acids), to address both the pseudarthrosis as well as the remaining joints in the body that might suffer from exaggerated wear and tear due to postural compensations.^{2, 11, 12, 14, 16, 18}

Summary

Dogs are able to do exceedingly well after a femoral head and neck excision if they if they are encouraged and enticed to utilize the surgical limb. Physiotherapy is essential in attaining this goal.

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