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Histological studies on cranial cruciate ligament reconstruction in dogs with whole thickness skin, patellar ligament grafts*

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Ruptured cranial cruciate ligament is one of the common orthopaedic injuries in dogs. If untreated it leads to degenerative diseases in stifle joint. Recently, successful results have been reported in dogs using an autogenous medial (Lam 1968, Abe *et al.* 1993) or lateral (Shires *et al.* 1984) third of patellar ligament. Bennet and May (1991) and Mcpherson and Allan (1993) recommended combined use of patellar ligament and fascia lata. The present study was undertaken to assess the adaptability of autogenous medial or lateral patellar ligament graft with fascia lata to replace ruptured cranial cruciate ligament in dogs. These procedures were compared with whole thickness skin grafts. Success of these procedures was evaluated basing on functional limb usage and gross and histological changes in the joint and graft tissue.

Mongrels (40) of either sex weighing 15 to 30 kg and without any stifle joint abnormalities were used in the present study.

Following premedication with atropine and trifulupromazine hydrochloride, anaesthesia was induced by intravenous infusion of 2.5% thiopentone sodium @ 25 mg/kg body weight. The animals were intubated and anaesthesia was maintained with ether oxygen mixture using Boyle's anaesthetic apparatus. A lateral parapatellar incision was used for rupture and reconstruction of ruptured cranial cruciate ligament with whole thickness skin or lateral third of patellar ligament and fascia lata. The medial parapatellar incision site was used for reconstruction with medial third of patellar ligament and fascia lata.

Following lateral parapatellar incision, the joint was entered at the level of the patellar ligament, about 1-2 mm lateral to it. The patella was luxated medially in lateral parapatellar approach and laterally in medial parapatellar approach, with the limb in extended position. Strict attention was paid to haemostasis. A part of infra patellar fat pad was excised for better visualization of cranial cruciate ligament, which was severed with limb in flexed position. Displaced patella was reduced on the femoral trochlear groove. The arthrotomy wound was closed in routine manner using No.1 silk in horizontal mattress fashion.

In control group (group 1), no graft was used for reconstruction of ruptured ligament. The ruptured cruciate ligament was reconstructed with whole thickness skin graft (group 2), medial third of patellar ligament with fascia lata (group 3) and lateral third of patellar ligament with fascia lata (group 4). The continuity of the grafts was maintained distally. A tunnel was drilled through the distal end of the lateral femoral condyle. The graft was pulled taut and the free end of the graft was reflected over and anchored to lateral femoro-fabellar fascia and joint capsule using No. '0' silk. The arthrotomy incision was closed in routine manner.

Post-operatively, all the dogs were allowed to use the limb without immobilization. The wounds were dressed daily and cutaneous sutures were removed on 10th post operative day. Two dogs from each group were euthanized at regular intervals of 7, 15, 30, 45, and 60th post-operative day. The joints were observed for the condition of the ligament. The joints were collected and fixed in 10% formal saline. The tissues were processed following procedure of Lillie and Fullmer (1976). Paraffin sections (5μ) were prepared and stained with haematoxylin and eosin (H&E) and van Giesons. The sections were examined microscopically for changes in the remnants of the ligament, graft materials and femoral tunnels.

Microscopic examination of normal cranial cruciate ligament exhibited dense collagen bundle which are arranged parallel to each other. The nuclei of fibrocytes were elongated. In control group, ruptured cranial cruciate ligament showed inflammatory reaction by 7 post-operative day, particularly around the blood vessels. There was hyaline degeneration at 45th day, which was in an advanced stage by 60th day.

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Fig. 1. Section of lateral third of patellar ligment with fascia lata. 45th day.

There was degeneration of hair follicles, epidermis and cutaneous glands in animals which were reconstructed with whole thickness skin graft by 15th day. This showed that the skin is loosing its normal architecture and trying to assume the function of the ligament. New collagen fibres formation was noticed by 30th day. The graft anchored to the bone by 45th day which was firm by 60th day.

In the group grafted with medial third of patellar ligament and fascia lata, it was surrounded by fibrin and red blood cells by seventh day. Granulation tissue invading the graft was observed by 15th day. The graft was highly vascular and new collagen fibres formed by 30th day. There was no difference between graft and newly formed collagenous tissue by 45th day. There were signs of fibres anchoring to the bone. The graft firmly adhered to the bone by 60th day.

In dogs, reconstructed with lateral third of patellar ligament and fascia lata, the graft was surrounded by fibrin and red blood cells at 7th and 15th day. Formation of granulation tissue was evident by 30th day. At 45th day, there was formation of new collagen fibres (Fig.1). There was no difference between the graft and newly formed collagen tissue at 60th day. Vascularization of medial third of patellar ligament with fascia lata graft was more and appeared early when compared to the other two grafts. Vaughan (1963) observed greater vascularization of the graft when passed through a tunnel in bone. New collagen formed early in full thickness skin grafts. However, all the 3 grafts exhibited good amount of collagen by 60th day. This activity might be responsible for converting the graft into ligamentous structure.

The results of microscopic studies suggested the superiority of medial third of patellar ligament with lata for the repair of ruptured cranial cruciate ligament in dogs. Whole thickness skin is the second choice followed by lateral third of patellar ligament with fascia lata.

SUMMARY

Cranial cruciate ligament was ruptured in 40 mongrel dogs of either sex. In 30 dogs, the ruptured ligament was reconstructed with skin, and patellar ligament along with fascialata. The stifles were evaluated up to 60th post-operative day. Control animals showed lameness and anterior drawer symptoms throughout the observation period. Among reconstructed groups, animals with joints stabilized by medial third of patellar ligament along with fascialata showed least degree of lameness and earlier normal functional limb usage when compared to other treated groups. Further, these animals showed early revascularization and collagen formation in grafts.

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