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STIFLE JOINT STABILITY BY EXTERNAL AND INTERNAL FIXATION WITH DIFFERENT MATERIALS FOLLOWING CRUCIATE LIGAMENT TRANSECTION IN DOGS

(With 3 Fig.)

By

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رسوخ مفصل الرصغه بالتثبيت الخارجي والداخلي بأستخدام مواد مختلفة بعد قطع الرباط الصليبي الأمامي في الكلاب

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لقد قيمت الياف الكربون مقارنة بخيوط الديكسون والحرير للتثبيت الداخلى لمفصل الرصغه بالأضافه إلى التثبيت الخارجى فى أثنى عشر كلبا وقد نوقشت النتائج الاكلينيكيه والفحص بعد الأعدام وكذا الفحص المجهرى. بينما لم تلاحظ فروق اكلينيكيه بين الحالات المثبته داخليا بأستخدام المواد المختلفة وكان الالتهاب أقل والأنسجه الضامه أكثر نضجا فى الحالات المثبته بأستخدام الياف الكربون.

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SUMMARY

Evaluation of carbon fibres in comparison to polyglycolic acid sutures and silk sutures for internal fixation of the stifle joint, in addition to the external fixation, after the experimental transection of the cranial cruciate ligament was performed in 12 dogs. The clinical, postmortem and histopathological findings were discussed. While no remarkable differences were observed clinically between the cases where the different materials were used for the internal fixation of the stifle joint, the least inflammatory reaction and most mature fibrous tissue were evident microscopically in those cases which were operated using carbon fibres.

INTRODUCTION

Rupture of the cranial cruciate ligament is a common cause of hind limp lameness in dogs *(KIRBY, 1992)*. It is well astablished that rupture of the cranial cruciate ligament results in progressive degenerative changes within the joint *(ARNOCZKY and MARSHALL, 1981)*. The animals that are left untreated begin to show degenerative joint changes within weeks and severe changes within months *(BRINKER, 1983)*. Therefore, such injuries should be repaired *(BOJRAB, 1983)*.

Although the surgical repair of the cranial cruciate ligament has undergone considerable development, the comprehensive review of the techniques and materials used for the repair and reconstruction of the ligament can leave one bewildered and confused *(RUDY, 1974; KNECHT, 1976; ARNOCZKY et al, 1982; PICHLER et al, 1982; NOYES et al, 1983; AMIEL et al, 1986; JOHNSON et al, 1989 and NOYES and BARBER, 1991)*.

The present experimental study was designed to evaluate the use of carbon fibre prosthesis in comparison to polyglycolic acid sutures and silk sutures as internal fixation, in addition to the external fixation to obtain stifle joint stability following the experimental cranial cruciate ligament transection in dogs. The clinic and macromorphological as well as the micropathological findings were discussed.

MATERIALS AND METHODS

The study was conducted on 12 apparently healthy mongrel dogs. The animals were divided into 4 equal groups; each of 3 animals. Surgery was performed under effect of thiopental general intravenous anaesthessia after premedication with

combelen (Bayer) intramuscularly in a dose rate of 0.2 mg/kg. BwT. The animals were right sided unilatererally operated after the aseptic preparation.

A lateral para patellar arthrotomy was performed, where the patella was tracted medially and the joint was manipulated to expose the cranial cruciate ligament and the later was severed using long curved dissecting scissors. In one group the joint was not internally fixed, but in the other groups the stifle joint was internally fixed by the different materials, in addition to the external fixation. The suture materials were threaded through double tunnels in the femur and tibia. The femoral tunnels were drilled in the lateral side of the femoral condyle, and tibial tunnels were done in the medial side of proximal tibia *(STEYN, 1984)*. The suture material was threaded through the tunnels and tightly tied in a knot on the medial side of the proximal tibia, while the joint was fully extended.

Group I: carbon fibre prosthesis: The carbon fibre filaments were twisted and woven to from a twist about the same size of the cruciate ligament. The material was steralized by the autoclave before use.

Group II: Braided polyglycolic acid suture (Dexon): Size 2/0 polyglycolic acid suture (Dexon, Davis & Geck company) was used. Four thteads of the material were twisted and threaded through the already formed tunnels to replace the transectected ligament.

Group III: Braided silk suture (Mersilk): Size 2/0 braided silk suture (Mersilk, Ethicon. Ltd.) was used. Four threads of the suture material were twisted and threaded through the tunnels to replace the transected ligament.

Group IV: The control group: The transected cranial cruciate ligament was left without substitution.

Before closure of the arthrotomy wound the joint was thoroughly flushed with saline solution. The joint capsule was closed using size 3/0 chromic catgut in a simple contineous pattern. The subcutaneous tissue and skin were closed as usual. The limb was bandaged and protected by plaster of paris bandage cast from belw the hock and upward as much as possible. The cast was changed 10 days postoperatively, where, the skin sutures were removed. The cast was removed one week later. Systemic antibiotic therapy began 12 hours preoperativly and repeated every 12 hours postoperatively for 5 successive days.

The animals were observed for one and falf month postoperatively. The joint was examined clinically preoperatively and after one and one and half montth postoperatively.

For postmortem macro and micromorphological examination on animal of each group were sacrificed one month postoperatively and the rest were sacrificed one and half month after the operation. Specimens were fixed in 10% buffered formaline, processed and the sections were stained using haematoxylin and eosine stain, and Masson trichrome stain. The stained sections were examined by the light microscope, where the findings were recorded.

RESULTS

Postoperatively, the animals (group I, II&III) began to bear some weight on the operated limb within 2 weeks. The degree of lameness decreased gradually to disappear within one month postoperatively. The operated stifle appeared swollen in comparison to the non operated side within the first 3 weeks postoperatively. After that, the operated stifles appeared more or less as the non operated ones. No difference was observed between the cases internally fixed by the use of the different materials (group I, II&III). The joint stability wasregained within one month in all animals of group I, II and III. The animals in the control group where, no internal fixation of the joint was performed, lameness and jount instability persisted with no remarkable improvement.

Macroscopic examination revealed that the connective tissue formation was abundant in case of carbon fibre implantation and theleast was in the animals which were operated using silk.

Microscopical examination of the animals, where the joint was internally fixed using carbon fibres (Group !), revealed mild chronic inflammatory reaction around the fibre site (Fig. I). Mature collagen fibres were evident around the carbon fibres. The synovial membrane showed areas of mild giant cell reaction and areas of fibrosis.

In the animals, which were operated using polyglycolic acid sutures (group II) to fix the joint, moderate granultion tissue and fibrosis were seen. The synovial membranes showed moderate granulation tissue reaction (Fig. 2). In group III, where the joint was fixed with silk, there was marked chronic inflammation with prominent giant cell reaction (Fig. 3). The synovial membrane showed fibrosis and granulation tissue formation.

DISCUSSION

Joint instability after surgical replacement of the cranial cruciate ligament may be due to a number of factors.

Autogenous grafts of skin, fascia or tendon may degenerate, stretch or rupture. While synthetic materials such as braided nylon, although providing excellent stability initially, must eventually fragment and break when subjected to the continual stresses of joint movement (*DENNY and GOODSHIP, 1980*). It has been established that carbon fibers can be used in biological situations to induce correctly aligned collagenous tissue by acting as a biocompatible scaffold for the growth of fibroblasts and subsequent deposition of collagen (*JENKINS et al, 1997; JENKINS, 1978; VAUGHAN & EDWARDS, (1978 and GOODSHIP et al, 1978, 1980*).

While no remarkable differences were observed clinically between the animals after the internal fixation of the stifle joint using different materials, the least inflammatory reaction and most mature fibrous tissue were microscopically evident in case of carbon fibres.

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Fig.(1):Mild chronic inflammatory reaction around carbon fibres.

Fig.(2):Moderate granulation tissue and fibrosis after replacement of the ligament with polyglycolic acid sutures The synovial membrane shows mild inflammatory reaction.

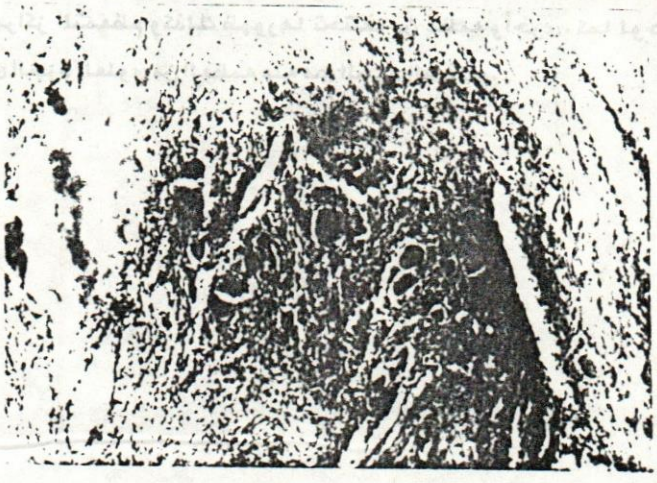

Fig.(3):Marked chronic inflammation with prominent giant cell reaction after replacement of the ligament with silk.