STIFLE SURGERY COMPLICATIONS

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The stifle joint is the commonest joint treated surgically by veterinary orthopaedic surgeons. In this presentation, we will use a case-based approach to discuss the commonest problems related to the commonest surgical procedures; namely, CCL and patella luxation surgery. The following notes are divided into complications related to CCL surgery followed by complications related to patella luxation surgery.

Complications of CCL surgery

Surgical options for CCL disease:
Surgical treatment options for CCL disease are divided into those providing either passive or dynamic stifle stability. Extracapsular and intracapsular stabilization techniques confer passive stability to the joint. Tibial osteotomy techniques provide dynamic stability whilst the joint is loaded. Techniques differ in concept, technical difficulty, invasiveness, potential risks, equipment, rate of recovery, completeness of recovery and cost. Treatment should be recommended based on the best evidence. Until recently, clinical studies had failed to establish a clear advantage of one surgical technique above another. Two recent studies applied random allocation of dogs into groups treated either by tibial plateau levelling osteotomy (TPLO) or lateral fabellotibial suture (LFS). Dogs were reassessed in the short-, medium- and long-term using owner evaluation and force plate analysis (Gordon-Evans and others, 2013; Nelson and others, 2013). Both procedures induced improvements in limb function with comparable improvement in clinical outcomes such as goniometry and thigh circumference, but dogs treated by TPLO had better ground reaction forces, and higher owner satisfaction than those treated via LFS.

Surgical technique can be divided into two important components; namely, intra-articular inspection and stifle stabilization.

Intra-articular inspection:
Although stifle joint inspection should be considered mandatory in patients presenting with CCL disease, there has been recent controversy regarding the necessity for arthrotomy. The evidence supporting intra-articular inspection of stifle joints affected by CCL disease is compelling:
Advantages of stifle joint inspection:

- Meniscal injury is a very common cause of significant morbidity: In one study, dogs with concurrent meniscal injury were found to be more lame than those without meniscal injury (Wustefeld–Jannsens and others, 2014).
- Reported incidence rate of meniscal injury is 10-70% (Hayes and others, 2010).
- Clinically unimportant meniscal injuries have not been reported either in dogs or humans. Human meniscal damage causes discomfort and progression of degenerative joint disease.
- Meniscal injuries are often the cause of a poor response to non-surgical management. In one study, 73% of large breed dogs and 100% of small breed dogs that did not improve after non-surgical management had meniscal injuries (Vasseur, 1984).
- Failure to improve after CCL repair is frequently attributed to lack of identification of meniscal tears at the time of surgery (Thieman and others, 2006).
- Visual confirmation of CCL injuries can be made prior to performing potentially invasive surgery.

Disadvantages of stifle joint inspection:

- Although meniscal injuries can occur with partial CCL rupture, they are uncommon in dogs with mild lameness and minimal instability.
- In one study, the overall complication rate after TPLO was significantly higher in dogs that had a full arthrotomy than those that had no arthrotomy (Stauffer and others, 2006).

Decision-making for CCL stabilisation surgery:

An algorithmic approach can be applied to CCL stabilisation surgery whereby each patient is assessed according to the unique mechanical, biological and clinical factors that influence the healing process (Figure 1). A numerical score from 1-10 is assigned to the factors that influence the healing environment after CCL repair. Low mechanical and clinical scores imply a suboptimal mechanical environment during the first few weeks of recovery. This should prompt the selection of a robust and durable repair that is not reliant on good patient compliance for an optimal outcome. Tibial osteotomy has an advantage over extra-capsular repair in this instance. Low biological scores imply a greater chance of relatively slow and potentially incomplete recovery. Surgery that relies on a benign intra-articular environment (intra-articular repair) or periarticular fibrosis for stabilization of the joint (extra-capsular repair) carries a higher risk in patients with low biological scores. The decision process is also strongly influenced by the incidence and nature of intra-operative and post-operative complications.
Figure 1: Algorithm for assessment of the factors that influence risk after CCL repair. These risks must be carefully considered when selecting the most appropriate surgical technique.

**Intra-articular stabilization:**
The damaged CCL is replaced with a ligament prosthesis intended to replicate the original CCL. Many graft tissues have been used including fascia lata, patellar tendon, hamstring fascia and skin. Intra-articular CCL repair has fallen out of favour due to a relatively slow and inferior recovery and a high incidence of complications compared with other techniques (Conzemius and others, 2005).

**Extra-capsular stabilization:**
The commonest method employed for femorotibial joint stabilization is the lateral fabellotibial suture (LFS). Monofilament materials used for LFS include nylon, polypropylene and stainless steel. Multifilament materials include polyblend (Fiberwire, TightRope, Arthrex) and polyethylene (LigaFiba, Veterinary Instrumentation). Braided materials have improved handling properties and superior biomechanics compared with monofilament materials but carry a significantly increased risk of infection and sinus formation (see below).
Extracapsular sutures cannot precisely mimic the functions of the CCL because it is impossible to achieve isometric anchorage points. Consequently, over-tensioning of a LFS causes reduced stifle range-of-motion, pathologically increased joint compressive forces, and excessive external tibial rotation (Tonks and others, 2010). This may predispose to early failure due to suture creep, breakage, or failure of the fabellar anchorage site (Hill and others, 1999). Conversely, under-tensioning leads to persistent stifle instability that can cause ongoing pain, loss of function, and meniscal injury. In the long-term, significant ongoing cranial draw has been recognized in approximately half of dogs treated by extracapsular repair (Moore and Read, 1995); however, the relationship between recurrent cranial draw and lameness is complex because the presence of cranial draw 6 weeks postoperatively does not relate to lameness (Hill and others, 1999).

Complications
Post-operative complications are divided into mechanical and biological categories. Mechanical complications include implant failure, subsequent meniscal injury, tibial or fibular fracture, patella luxation, and patellar tendonitis. Biological complications include periprosthetic infection, septic arthritis, and delayed osseous healing. The complications associated with osteotomy procedures can have potentially severe consequences. For example, patellar luxation, septic arthritis and diaphyseal tibial fracture (Figure 2) are all uncommon complications that require major surgical intervention or long-term medical management.

<table>
<thead>
<tr>
<th></th>
<th>Overall complication rate</th>
<th>Re-operation rate</th>
<th>Meniscal injury</th>
<th>Incisional complications</th>
<th>Other complications</th>
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<tbody>
<tr>
<td>LFS</td>
<td>17.4-21%</td>
<td>7.2-21%</td>
<td>1.9-19%</td>
<td>8.8%</td>
<td>Common peroneal nerve entrapment, ongoing instability,</td>
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<td>patellar luxation, periprosthetic infection, septic arthritis</td>
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<td>Popliteal artery laceration, tibial tuberosity fracture,</td>
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<td>fibular fracture, implant failure, patellar tendonitis,</td>
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<td>patellar luxation, delayed osseous healing, periprosthetic</td>
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<td>infection, septic arthritis</td>
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<td>TPLO</td>
<td>14.8-28%</td>
<td>5-9%</td>
<td>0-10.5%</td>
<td>2-16%</td>
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Tibial tuberosity fracture, diaphyseal tibial fracture, implant failure, patellar tendonitis, patellar luxation, delayed osseous healing, periprosthetic infection, septic arthritis

TTA 19-59% 6.2-11.3% 3.4-21.7% 6.6-21%

Figure 2: Complications after CCL repair surgery.

Postoperative septic arthritis:

Extracapsular repair

Post-operative surgical site infection rate after extracapsular suture was as high as 18-21% when multifilament suture material was used for extra capsular stabilisation. (Dulisch, 1981a and b). Nevertheless, due to mechanical concerns related to monofilament suture materials, there has been a recent resurgence of multifilament suture for extracapsular repair. As there are currently no long-term studies assessing complication rates for these recent variations in extracapsular implants, it remains to be seen whether the previous problems of chronic periprosthetic infection will resurface. When periprosthetic infection or septic arthritis occurs after extracapsular repair, resolution of infection usually requires removal of the non-absorbable suture (Marchevsky and Read, 1999).

TPLO

Postoperative infection after TPLO manifests as superficial wound infection, septic arthritis, or osteomyelitis. The reported infection rates of 0–7% (Pacchiana and others, 2003, Priddy and others, 2003, Stauffer and others, 2006, Fitzpatrick and Solano, 2010) are higher than the 1.5–2.6% reported for clean surgical procedures (Rosin and others 1993, Lipowitz, 1996). Radiographs should always be acquired in the event of sudden onset lameness after any osteotomy surgery because of the close relationship between mechanical instability (related to bone/implant failure) and infection. Treatment of deep periprosthetic infection and septic arthritis after TPLO requires long durations of oral antibiotic therapy (e.g. 2 months), and in one third of cases, implant removal after the bone has healed (Fitzpatrick and Solano, 2010).

TTA

A post-operative TTA incisional infection rate of 6.6% has been reported (Wolf and others, 2012). Although this in a similar range to the overall infection rate after TPLO, rates of deep periprosthetic infection and septic arthritis are as low as 0-1% (Hoffman and others, 2006, Lafaver and others, 2007, Stein and Schmoekel, 2008, Wolf and others, 2012). If recalcitrant deep infection does occur and implant removal is required to resolve the infection, this can be technically demanding. Standard TTA cages and
forks can be removed, but cages typically have sufficient osseous ingrowth that they can only be explanted after removing the adjacent bone using an oscillating saw or osteotome. Removal of OrthofoamMMP implants is particularly challenging. An additional important problem occurs because advancement cannot be maintained after removal of the titanium wedge. Revision therefore requires replacement of the tibial tuberosity in its original anatomical position with pin and tension band wire fixation of the tuberosity fragment, or revision to standard TTA with insertion of an antibiotic impregnated collagen sponge.


