Case Abstracts
# Table of Contents

<table>
<thead>
<tr>
<th>Section</th>
<th>Pages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abdominal Surgeries</td>
<td>3 – 6</td>
</tr>
<tr>
<td>Cardiovascular Surgeries</td>
<td>7 – 10</td>
</tr>
<tr>
<td>Neurosurgeries</td>
<td>11 – 17</td>
</tr>
<tr>
<td>Orthopedic Surgeries</td>
<td>18 – 21</td>
</tr>
</tbody>
</table>
Radiographic Evaluation of Controlled Release Coatings Delivered Directly to the Jejunum of Yucatan Micro-Pigs via a Jejunal Intussuscepted “Nipple Valve”; Mendenhall HV, 15th Annual Meeting, Academy of Surgical Research, Scottsdale, Arizona, September 2-4, 1999

Delineation of the multiple interactions between gastrointestinal (GI) physiology and dosage form behavior is important in optimizing oral drug delivery design. The use of the pig for this type of work is new. The objective of this study was to establish via fluoroscopy, the intestinal transit time of a barium tablet, coated with a timed-release substance, following insertion directly into the jejunum, via a surgically-created intussuscepted “nipple valve”, thus bypassing the stomach, in four Yucatan micro-pigs. The surgical procedure used was a modification of the Koch’s pouch for creation of a continent ileal reservoir.

Thirteen days after surgery, the coated tablet was inserted directly into each animal’s jejunum via the intestinal conduit and through the nipple valve. The tablet was followed through the intestinal tract by fluoroscopy for up to 12 hours. Arrival of the tablet into the equivalent of the ascending colon was presumed to occur when the tablet was left of the median plane and behind the stomach. Passage through the ansa spiralis was presumed to be complete when the tablet was in the right sublumbar region and into the descending colon when it was again slightly to the left of the midline.

The results of this study indicated that the rate of peristalsis within each segment was very consistent between animals. The small intestinal transit time was 3.5 hours, arriving in the rectum after 10.5 hours. This method of determining the transit time, and/or dissolution of tablets in the intestinal tract of the pig has a number of advantages over pharmacokinetic analysis. The use of the biological conduit allowed for easy dosing, and for the animal to be used for numerous similar studies.
Implantation of the Respiratory Telemetry Device in Beagle Dogs; DesPlaines D, Mendenhall HV, Wilson S & Cunningham M; 19th Annual Meeting of Academy of Surgical Research, St. Louis, Missouri, October 2-4, 2003

Eight beagle dogs were surgically implanted with the TL11M3-D70-PCP telemetry device. This device allows for telemetric monitoring of two pressures simultaneously. The two pressures monitored were direct arterial and intrathoracic (pleural) pressures. The animals were also instrumented with indwelling venous and arterial catheters attached to vascular access ports (VAPs).

The animals were placed in semi-dorsal recumbency with one hind leg abducted and extended. A feeding tube was placed into the stomach. Through a midline laparotomy, the transmitter was enclosed within an omental pocket and sutured to the abdominal wall. An incision was made through the serosal layer of the esophagus at the level of the cardiac sphincter. One of the pressure catheters was then inserted along the groove of the director, which was then removed. The pleural pressure wave form was then visually verified on the telemetry computer monitor. The catheter was positioned until a maximal pressure change of about 5 mmHg with minimal cardiac artifacts was observed. It was then secured in place with both a purse string and “Whipple”-type suture pattern. The other pressure catheter was inserted into the internal iliac artery and secured in position with two ligatures around the artery and the catheter. The electrocardiogram leads were configured for lead II. The negative lead was routed subcutaneously to a position near the right axillary area, and was placed below the pectoral muscles. The positive lead was placed near the last left intercostal space. Approximately 5 to 8 cm of the insulation was removed and the exposed wire was looped and held in place with one or two non-absorbable sutures.
Implantation of the Respiratory Telemetry Device in Beagle Dogs (cont.)

The opposite femoral artery and vein were then isolated, a 7 Fr catheter introduced into each of them, and two ligatures tied around them. The VAPs were placed in separate subcutaneous “pockets” over the last few ribs. The VAPs and catheters were "locked" with a solution of 50% dextrose containing heparin (100 IU/mL) and vancomycin (1.0 mg/mL). Proper functioning of the device and VAPs was confirmed before a study start, and/or monthly.

The pleural pressure readings seemed to "settle out" about a month after the implantation. This procedure allowed for respiratory, as well as direct blood pressure and electrocardiographic telemetric monitoring. All animals were successful and both VAP/catheters have remained bidirectionally patent for six months.
**Abdominal Surgeries**

---

**Surgical Instrumentation of Rats to Allow for Chronic Direct Infusion into the Urinary Bladder over an Extended Period in the Conscious Animal; Piechowiak M, Wadanoli M, Mendenhall HV & Horvath C; 36th Annual Meeting, Society of Toxicology. Cincinnati, Ohio, March 9-13, 1997.**

To determine the effect of test articles on the urinary bladder of conscious laboratory rats, it was necessary to develop a method to chronically administer substances directly at frequent intervals for defined retention periods. For anatomical reasons, the bladder of rats, especially males, is impossible to catheterize.

Under appropriate anesthesia and utilizing aseptic technique, the trigone of the bladder was exposed, and the urethra mobilized to accommodate circumferential placement of a 2mm vascular occluder so as to allow compression of the urethra without compression of the ureters. A specially designed fenestrated catheter was then introduced into the bladder lumen through a small cystotomy in the apex. The intra cystic catheter was held in place with a purse-string suture between two suture discs, one extra luminal and one intraluminal next to the bladder mucosa. The extra luminal disc was sutured to the serosal surface of the bladder wall. Both catheters (from the occluder and the urinary catheter) were routed subcutaneously to the lateral abdominal region where they were attached to subcutaneously placed vascular access ports (VAPs). No special protection was required.

Following a period of recovery, test articles could be easily administered directly to the bladder in the conscious animal by first inflating the occluder to prevent voiding. This method allowed for collection of up to 1 mL of urine after an occlusion period of only one hour. The test article could be directly removed after an appropriate residence time. When the occluder was deflated, the animal could urinate normally. We have used this system successfully in 28 rats for up to a two week period of dosing.

E5564, a TLR4 antagonist is expected to block LPS-mediated diseases. To support use during CPB surgery, E5564 was evaluated to determine if there was an adverse effect on oxygenation, heparin reversal, and to determine plasma concentrations in mongrel dogs. Blood was collected for 18 days prior to surgery by the Domino method for auto transfusion at surgery. The animals (3 males/group) received either E5564 (1 mg/kg/hr) or its vehicle (2% lactose/4% dextrose-phosphate buffer) by IV infusion at 2 mL/kg/hr, starting at the time surgery commenced. The heart was arrested and the animal's core body temperature was cooled to ~28°C for 60 min, while on bypass. The animal was warmed to 35-38°C, resuscitated and taken off bypass. The dogs were ventilated with room air and their condition monitored for another 30 min.

During the surgery, the following parameters were assessed: anesthesia time, surgery time, CPB time, heparin dose, protamine dose, ECG, heart rate, systolic, diastolic and mean arterial pressure, central venous pressure, pulmonary artery pressure, oxygen saturation, end-tidal carbon dioxide, PO2, PCO2, base-excess, HCO3-, pH, hematocrit, Na+, K+, Ca, activated clotting time, rectal and esophageal body temperature, total volume of lactated Ringer's solution administered, urine output, defibrillation attempts, hematology, coagulation, blood chemistry, and pharmacokinetics.

All animals tolerated the cardiopulmonary bypass procedure well. There were no differences observed between E5564 and vehicle groups in all parameters tested. Similar plasma levels of E5564 from all three treated dogs were obtained and comparable to those seen in a 72-hour infusion toxicity study in the dog. In conclusion, E5564 did not compromise any CPB process or measured parameter. CPB did not interfere with the pharmacokinetics of E5564.
**Cardiovascular Surgeries**

*Working*" versus "*Non-working*" Heterotopic Heart Transplantation Mendenhall HV;

26th Annual Meeting of Academy of Surgical Research, Clearwater Beach, FL, September 30- October 2, 2010

Heterotopic placement is preferred over orthotopic placement, since rejection or insufficient function of the graft does not result in the recipient’s death. Sequential examination of the tissue over time aids in determining the pathophysiology of the rejection process.

Heterotopic heart transplants may also be implanted as either “non-working” or “working”. A direct correlation between graft rejection and cardiac contractile function cannot be obtained in the heterotopic non-working heart model in terms of left ventricular work, as well as being difficult to obtain hemodynamic data in situ. The “non-working” heart model is used in early development of anti-rejection methods, and the “working” heart model is used to determine actual function in the absence of rejection, prior to performing definitive orthotopic implantation procedures.

“Non-working” model: Ligation of the atrial incisions and dissection of the adventitial tissue between the ascending aorta and the main pulmonary artery. End-to side anastomosis between the donor ascending aorta and the recipient infrarenal abdominal aorta. End-to-side anastomosis between the donor main pulmonary artery and the inferior vena cava. The right atrial incision is then ligated.

Working Model: The main pulmonary is doubly ligated, and the right atrial appendage is opened. The fossa ovale is excised to create an atrial septal defect about 1 cm in diameter. The tricuspid valve is rendered incompetent. End-to side anastomosis between the donor ascending aorta and the recipient infrarenal abdominal aorta. End-to-side anastomosis is between the right atrium and the inferior vena cava.
Implantation of vascular grafts for testing of designs or materials that may reduce the incidence of neointimal hyperplasia at the distal anastomosis, commonly requires the implantation of long (>20 cm) grafts. Pigs are the animal model of choice for such studies, since they do develop neointimal hyperplasia in a very similar fashion to humans. Grafts of this length require that they be implanted as a thoraco-abdominal aortic bypass. The surgical techniques required for such implantations are relatively routine; however, in order to insure a survivor, the anesthetic and pharmacologic management during the procedure are of primary importance. The literature states that a 30% death rate can be expected. It is our contention, however, that with proper preparation for monitoring of all vital signs, anticipatory anesthetic and pharmacologic management to maintain homeostasis, and with the use of a cranial-caudal shunt during the thoracic anastomosis, the mortality rate can be greatly reduced.

To date, we have implanted a total of 35 animals with vascular grafts as a thoraco-abdominal aortic bypass. The graft extended from the mid-portion of the thoracic aorta to the infrarenal abdominal aorta. Following completion of the implantation, the aorta was ligated immediately distal to the proximal anastomosis. Eight of the first 12 animals died shortly after the conclusion of surgery due to the development of extreme hypotension that eventually became unresponsive to catecholamine therapy. Three of these animals also developed excessive hemorrhage due to prolongation of the action of heparin at 125 IU/kg. All twelve animals exhibited extreme hypotension after releasing the thoracic aorta, only three of which recovered from this event. This phenomenon followed a period of extreme hypertension during the time the thoracic aorta was occluded. A review of the physiology involved indicated that this response may have been due to an over reaction of the renin-angiotensin system during the period of splanchnic ischemia.
Cardiovascular Surgeries

The Anesthesia, Pharmacological and Adjunctive Surgical Management of Thoracoabdominal Bypass Grafting in Pigs (cont.)

The remaining 23 animals, all of which survived, were prepared by doubly catheterizing the external jugular vein to allow for monitoring of CVP and for the administration of intravenous fluids and necessary drugs. The carotid artery was catheterized to allow for pressure measurements proximal to the proximal anastomosis, and the femoral artery catheterized to allow for these measurements distal to the distal anastomosis. The femoral vein was catheterized to allow for the immediate administration of catecholamines should they be needed. All were fitted with a cranial-caudal shunt system through the two pressure lines that was used to direct blood to the splanchnic circulation during the period of thoracic aortic occlusion. This method effectively eliminated both the initial hypertension, and the subsequent hypotension.

The dose of heparin was reduced to 100 IU/kg, which proved to be generally effective at maintaining the ACT at >3x baseline. To prevent the phenomenon of “third spacing” and pulmonary edema, 2-mg/kg dexamethasone was administered prior to surgery, followed by an additional dose of 1 mg/kg at the conclusion of the anastomoses. Furosemide (8 mg/kg IV) was also given at this time. No more than one L of crystalloid was administered intravenously, being followed with the administration of colloids (Hetastarch®). The animals were maintained in both a metabolic and respiratory alkalotic state, with additional administration of Na bicarbonate prior to releasing the thoracic aorta. The thoracic aorta was slowly released over a period of about 5 minutes. Other electrolytes (Na++, K+ and Ca++) were administered as needed. These procedures have been found to be highly effective in preventing intraoperative mortality in this very difficult model.
An Improved and Reliable Technique for Determining the Efficacy of Dural Sealants; Mendenhall HV, Abtin R & Stricker-Krongrad A; Congress of Neurological Surgeons Annual Meeting, September 20-25, Orlando, FL, 2008

Synthetic sealants are being developed to aid as an adjunct to dural closure. The animal model used to test the efficacy of these sealants is to cover a loosely closed 2-cm supratentorial durotomy in the dog with them and test for leaks using a “Valsalva”-like maneuver. A true Valsalva maneuver cannot be performed in a dog, but a similar effect is seen by raising intrathoracic pressures. This method doesn’t represent the actual ICP and can be maintained for only a short period of time. We developed a technique that accurately measures ICP and allows for its increase to any desired level and time.

Prior to creation of a durotomy in 25 dogs, the cranial subarachnoid space was catheterized with a 5 Fr Millar pressure sensing catheter through a small craniotomy. The spinal subarachnoid space was catheterized with an 18 gauge IV catheter through a hemilaminectomy at C2. The IV catheter was connected to a reservoir of 0.9% saline containing methylene blue, positioned 20 cm above the animal’s head. The standard durotomy with loose closure was then performed through a 3 x 2 cm contralateral craniotomy. The ICP was elevated to ~18 cm H2O by infusing the saline/methylene blue, and was continued until dye was seen flowing from the durotomy. The sealant was then applied over the durotomy. The ICP was maintained for 10 minutes, and the site observed for the presence of methylene blue. At necropsy, long term efficacy was tested by similar catheterizations and raising the ICP to 55-60 cm H2O and observing for leaks.

These methods worked well, did not greatly prolong the surgery, and had no adverse effect on postoperative course. This method allows for very accurate measurement of a clinically relevant ICP at which leakage may occur from a sealant-covered durotomy. An accurate determination of the efficacy of, and any differences between, different types of candidate sealants can be made.
According to the FDA, any material intended for replacement or sealing of dura must be evaluated by conducting implantation studies in animals at the intended anatomic site, with subsequent histologic assessment of the tissue reaction to the material. Current knowledge of wound healing after such implantation is limited, and very few comparative (i.e., similarity to man) animal studies are available. Since swine are known to simulate human wound healing, the tendency to use them as an animal model for duraplasty studies is tempting. Before attempting such studies, a comparative anatomical study was performed.

The skulls of 15 Yorkshire and 15 Yucatan swine (35-50 kg), ranging in age from three to six months were hemisected and examined for applicability to supratentorial duraplasty studies. The same procedure was done in the same number of mongrel dogs (20-25 kg), ranging in age from 1 to 2 years.

Regardless of breed, a radical difference in the gross anatomy of swine was noted with increasing age. When less than 4 months old, the frontal sinus was small and confined to the rostral frontal bone. A routine temporo-parietal craniotomy was accomplished. In animals greater than 4 months of age, the frontal sinus extended caudal almost to the foramen magnum and occipital condyles and laterally into the supraorbital and zygomatic processes. A simple temporoparietal craniotomy was thus not possible in the older animals, since the external plates of the cranial bones were covered with the frontal sinus. Implantation of foreign materials onto a durotomy could not be performed without contamination, and thus, false negative results would be obtained. No such anatomical limitation to these procedures was found in any of the dogs examined. Survival, long term duraplasty studies cannot be conducted in swine due to advancement of the frontal sinus over the cranial bones with age. Dogs appear to be the ideal animal model for such studies.

Background: Watertight repairs of the dura is imperative after neurosurgical procedures involving the brain or spinal cord because inadequately treated leakage of cerebrospinal fluid (CSF) from punctured dura can have serious consequences such as meningitis, arachnoiditis, or epidural abscess.

Objective: The efficacy of Evicel™ Fibrin Sealant (Human) to prevent CFS leakage was assessed using a 2.0-cm Durotomy mongrel dog model, and the tissue response was compared with Tisseel™ (a fibrin sealant) and Duraseal™ (a synthetic polyethylene glycol [PEG] hydrogel sealant).

Methods: The canine Durotomy repair model was used. This well characterized model assesses the ability of sealants to achieve intraoperative watertight seals on the dura mater, and also assesses long-term safety and efficacy. This study included 27 mongrel dogs and had a 28-day duration.

Results: The 3 sealants were 100% effective in preventing CSF leakage intraoperatively at 15 mmHg. The 2 fibrin sealants were 100% effective in postoperative sealing; the PEG hydrogel was not. Microscopically, the tissue changes induced by Evicel at the Durotomy site were similar in nature except for foamy macrophages seen only with the PEG hydrogel. The extent and severity of adhesions at 28 days was less with the fibrin sealants than the PEG hydrogel.

Conclusion: Evicel, a fibrin sealant, was safe and effective in achieving and maintaining a watertight seal of the dura. The performance of the fibrin sealants was similar to the synthetic PEG hydrogel sealant with the exception of a Duraseal™ animal, which leaked.
Continuous Infusion to the Lateral Ventricle of the Beagle Dog; Bayer K, Mendenhall HV, Howk K & LaRochelle A; 18th Annual Academy of Surgical Research, October 4th, 2002.

Twenty-two Beagle dogs were surgically implanted with an intraventricular catheter (Orthocath®), attached to an implantable pump (ANS). The catheter tip was placed in the lateral ventricle. The implantable pumps were accessed weekly to record the volume of material actually infused into the lateral ventricle, and to refill the pump. This volume over time correlated to infusion rate.

The animal was placed in sternal recumbency, with the head elevated on a firm pad so that the top of the skull was horizontal. Prior to implantation, the infusion pump was opened and filled. Under strict aseptic conditions, a 5-cm incision was made along the sagittal crest. The position for the intraventricular catheter was estimated to be ~38mm rostral to the external occipital protuberance and ~ 8mm lateral to the sagittal crest. A perpendicular drill hole was made at this site, down to the level of the dura mater, using increasing sizes of drill bits, up to ~3.2mm. The dura was incised with a hypodermic needle and a blunt ended pilot needle was introduced until CSF was observed. The needle was marked at this point to determine the depth to the lateral ventricle. The distal end of the catheter was trimmed to this length. The catheter was introduced into the lateral ventricle and screwed into place in the cranium.

The cutaneous trunci was incised and the plane between the external and internal abdominal oblique muscles identified. An intermuscular pocket was created between these two muscles; a trocar was passed from the cranial incision to this pocket and the catheter was passed through it. The pump was placed in the intermuscular pocket and immobilized. The two muscles were closed together tightly in order to eliminate as much dead space as possible. A protective bandage and jacket was placed over the pump incision site.
Animals were given Cefotaxime® (50mg/kg IM) BID for 2 days post-surgery and Ketorolac® (1mg/kg IM) SID for 3 days post surgery.

The surgical procedure was well tolerated by the animals. The implantable pumps allowed for continuous infusion without using jacket and tether; maintenance was performed once a week. Swelling at the pump site was minimal to non-existent. However, out of the 22 pumps, 9 were found to not be working correctly. This was found to be due to a malfunction in the pump itself. The tips of only seven of the catheters were found to actually be in the lateral ventricle. It was determined that better placement of the ventricular catheter needed to be 25mm to 33mm rostral, 5mm to 7mm lateral, and 18mm to 20mm deep. In addition, use of a stereotactic apparatus greatly improved the results.

Aggressive pharmacologic and surgical treatment of spinal cord injuries in 22 dogs and 3 cats resulted in a recovery rate of 44% of all 25 animals. Excluding 5 animals that were euthanatized at surgery because of visualized cord transection and 5 that died during surgery because of secondary lesions, the recovery rate was 73%. This is compared with a recovery rate of 39% (7/18) for animals treated with more conservative methods at the same institution during an earlier period. Of the 7 animals without spinal cord transection and treated within 4 hours of injury, all recovered, pointing to the merits of early surgical intervention.
A Comparison of Peripheral Nerve Repair Using an Absorbable Tubulization Device and Conventional Suture in Primates; Tountas CP, Bergman RA, Lewis TW, Stone HE, Pyrek JD & Mendenhall HV; J Appl. Biomaterials, 1993 Fall; 4(3);261-268

Median nerve regeneration was studied in 30 adult primates after repair by microsurgical suture or tubulization with a nonwoven, bioabsorbable, polyglycolic acid device. The two methods were compared electro physiologically and histologically 6 and 12 months after repair. The electrophysiology included recording of electrically evoked compound action potentials and subsequent determination of threshold, conduction velocity, amplitude, and area above the baseline for each component. Measurements were obtained before nerve transection and at the time of biopsy by stimulating both proximal and distal to the transection site. Analysis of all electrophysiological parameters revealed no statistically significant differences (p less than 0.05) between the two repair techniques. Histopathology included examination of cross sections proximal and distal to the repair sites and longitudinal sections through the coaptation site. End organs (Meissner's and Pacinian corpuscles and muscle) were sectioned to determine the degree of reinnervation. No significant differences between the repair techniques were observed by histological analysis of these sections. These evaluations indicated that the tubulization repair technique produced results comparable to that of suture-technique.
The Small Cow as an Animal Model for Lumbar Intervertebral Disc Replacement; Mendenhall HV; Podium Presentation, International Meeting on Advanced Spine Techniques, Banff, Alberta, Canada, July 7-9, 2005

It is generally accepted that there is no good animal model for pre-clinical studies involving the implantation of total disc or nucleus pulposus replacements. Commonly used animal models have included the sheep, goat swine and dog, despite the fact that vertebrae in these animals are quite small. Additionally, the biomechanical forces are quite different, commonly resulting in extrusion of the device, especially when within the nucleus pulposus. Finally, surgical access to the disc space in the larger animals requires a lateral approach. Cadaveric small bovines are an established animal species for spinal biomechanical studies since the vertebrae are of similar size.

We investigated the utility of this animal model (200 kg Corrientes with closed growth plates) for evaluation of the safety of an intervertebral disc replacement on a chronic basis as well. A left lateral approach to the lumbar discs was made in 25 animals. For nucleus pulposus replacements, a wedge osteotomy of adjacent vertebrae was made, retaining the superficial lateral ligament between the two bone blocks. A transverse annulotomy was made, the nucleus removed, and the test material implanted. The bone blocks were then replaced so that the ligament covered the annulotomy, and a piece of titanium mesh placed over the osteotomies and held in place with appropriate screws. Closure was routine. Necropsies were performed at 3, 6, 9 and 12 months. No implants extruded from the implantation site. The implanted disc spaces were embedded in PMMA, stained and evaluated. The interface between the test material and the adjacent tissue and cellular reaction was easily observed.
The Small Cow as an Animal Model for Lumbar Intervertebral Disc Replacement (cont.)

This animal model seems to allow the investigator to test a device intended for use in humans, rather than size it down. The wedge osteotomy and titanium mesh seems to prevent extrusion for nuclear replacement. These methods are not necessary for evaluation of total disc replacements or spinal fusion.
Orthopedic Surgeries


Mechanical properties of fascia lata autografts used to replace the anterior cruciate ligament (ACL) in the goat were measured at 0, 2, 4, and 8 weeks after surgery. The ACL was replaced in the right knee of 50 animals divided equally into two groups according to graft fixation technique: (a) two smooth staples at each end, with the tissue pulled back toward the joint over the first staple and (b) reinforced fixation with a spiked bushing placed through the tissue and a 3-cm-long flat polypropylene braid sutured to each end of the graft. Eleven unoperated contralateral knees were tested as controls. All statistically significant effects of the reinforced versus staple fixation were observed at 0 weeks, with the reinforced group showing less anteroposterior (AP) translation of the joint and greater maximum force and stiffness of the femur-graft-tibia units. The reinforced group had increased AP translation and decreased strength and stiffness by 2 weeks after surgery. Increased AP translation resulted primarily from increases in the low-stiffness region of the force-displacement curve (primary AP translation) and to a lesser extent from increased translation in the high-stiffness region (secondary anterior translation). Failures at 0 weeks with the reinforced fixation occurred at the bushing or end of the reinforcing braid, while all but one of the later failures occurred in the tissue mid-substance. In the staple group, maximum force was greater at 8 weeks than at 0 weeks, as the failure locations changed from the fixation to the tissue mid-substance.
Significant patellofemoral chondromalacia was observed three months after operations on goat knees that had an excised anterior cruciate ligament (ACL) replaced and then were immobilized for six weeks with a rigid external pin and frame fixator. To determine if the patellofemoral morbidity rate could be reduced, another group of goats was treated with the same operation but without immobilization. The legs of the animals in the immobilized group had muscle weakness and the animals only occasionally used their legs for the next three to four weeks. The animals in the mobilized group protected the leg for only one to two days after surgery, and by ten to 12 days were actively moving the knee. Severe patellofemoral articular cartilage erosions occurred in the immobilized goats but not in the mobilized group. Postoperative immobilization was detrimental to the joint function and to a successful ACL reconstruction.
Our Resources

Your Product

From Concept to

Clinical Application