A STUDY ON THE INNERVATION
OF THE EQUINE HIP AND KNEE (STIFLE) JOINT CAPSULES

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by
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Acknowledgments

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Introduction

During recent investigations with Drs. Diesem and Hunter on neurectomies and gait changes in ponies, this author became interested in the sensory nerve distribution to the proximal joints of the equine limb. A survey of the literature revealed a fair amount of information on the subject, yet a detailed, comprehensive report was lacking. There are few articles available in the literature with details to match the works by Wyke (21), Freeman and Wyke (4), or Andrew and Dodt (1), in which they reported on the nerve supply to the feline knee and ankle joint capsules. Similarly, the articular neurology of the ox, sheep and goat limbs have received more detailed attention in works by Gigov (9). Equine articular neurology with respect to the hip and stifle has not received the degree of attention required for the present level of veterinary science. The veterinary anatomy texts surveyed (3, 11, 13-20) are not in complete agreement as to which nerves supply the hip and stifle. Furthermore, no one defines the articular nerve supply as thoroughly as do the texts on human anatomy (2, 5, 10).

Less than half of the veterinary texts surveyed even mentioned articular innervation to the proximal aspect of the equine rear limb. Of those that did, most stated that branches from the sciatic and obturator nerves supplied the hip joint,
and the branches of saphenous and tibial nerves supplied the stifle joint. There remains the question of the distribution to the hip or stifle joint capsule, if any, by femoral, cranial, or caudal gluteal nerves in the case of the hip, or femoral, obturator, or peroneal nerves in the case of the stifle. This investigation intends to give this matter further study.

It is essential for today's veterinarian, whether functioning as diagnostician, surgeon, therapist, or researcher to have as thorough an understanding of articular neurology as any other aspect of limb form and function. The physicians echo this belief in human medicine. The details of articular neurology have been defined quite thoroughly in their literature. A more thorough understanding of equine joint innervation may provide more insight into the prevention, treatment and rehabilitation of animals affected by disease, in particular, lameness.

At the present time horses are being used less for agricultural purposes and more for recreation and entertainment. The increased numbers and their use for pleasure and competition riding as well as harness and turf racing have placed the horse in an environment of increased stress and trauma. This has led to more bone and soft tissue damage, hence lameness, and a greater demand upon veterinarians for more and better methods of treating this disease. This requires more knowledge of motion and kinematics as well as medicine and surgery. Articular neurology is one facet of this knowledge that should receive more definition.
Review of the Literature (Hip Joint)

The anatomy of the human hip joint (coxofemoral joint), with regard to the innervation of the joint capsule and associated ligaments has received much more attention and detailed observation than that of the domestic animals. Durward in Cunningham's text (2) of human anatomy details articular branches to the hip joint capsule from obturator, femoral and sciatic nerves. Gardner (5) also defines a similar distribution to the hip joint, with one addition. He describes a twig to the capsule that arises from the branch of the cranial gluteal nerve that supplies the tensor fascia latae muscle.

Gray's text (10) outlines the hip joint innervation as being supplied by branches of obturator and, or accessory obturator, femoral, and sciatic nerves. It also describes branches to the hip joint that arise from the nerve to the gemellus inferior and quadratus femoris muscles. This nerve, although defined separately, is usually considered a part of the sciatic trunk, branching from that trunk near its origin.

The human texts concur on distribution. They show that the branch of the femoral nerve which supplies the rectus femoris muscle dispatches a twig that courses satellite to the lateral circumflex artery and enters the anterior aspect of the hip joint capsule. Also, the anterior and posterior branches of obturator nerve and, when present, accessory obturator nerve, provide twigs at or near the obturator foramen which course to the fibrous joint capsule.
of the hip. The description of nerve fibers to the posterior aspect of the capsule includes a) small twigs arising from the sciatic nerve in its upper part just below the level of the greater sciatic foramen, b) branches from the sacral plexus, from the same spinal roots that form the sciatic nerve, or c) twigs which arise from the nerve which passes to the quadriceps femoris and gemellus inferior muscles. This latter nerve, in fact, is illustrated by Gray (10) as arising from the sciatic nerve at its origin from the ventral branches of lumbar and sacral nerves.

The anatomy of the innervation of the hip joint capsule of man is quite clear and detailed. That of the domestic animals and the horse in particular has not received as much attention. The information is less detailed and not readily available to the student of veterinary anatomy. There is no information or reference to such innervation in Sisson (19), Taylor (20), Rooney (17), Habel (11), Schmaltz (18), or Popeko (16). Koch (13) mentions that only fibers from the sciatic nerve supply the equine hip joint. Nickel, Schummer and Seiferle (15) state that the hip joint receives fibers only from the sciatic nerve. Ellenberger and Baua's text (3) cites Ghetie's (7) work on the innervation to the joints of the equine hind limb. It states that within the pelvic cavity a branch of the sciatic nerve arises from its cranial border and passes between the deep gluteal muscle and the ischiatic spine to supply the fibrous
joint capsule of the hip. There is no mention of innervation
of the hip joint by femoral, obturator or cranial gluteal nerves.

A search of the literature revealed little more information
concerning the hip joint innervation of other domestic animal
species. Gigov (9) does present a very good description of the
hip joint capsular innervation of the ox. He stated that
branches from saphenous, obturator and sciatic nerves were
traced to the joint capsule. The article states that the
saphenous branches, and often twigs from the femoral nerve pass
satellite to deep femoral artery toward the pectineus muscle.
Twigs from this branch course to the cranial aspect of the hip
joint capsule. The article describes the obturator branch as
arising from the nerve at the level of the obturator foramen.
This branch courses laterally parallel to the obturator ramus
of the medial circumflex femoral artery and ramifies in the
ventral aspect of the joint capsule. Gigov further describes
sciatic nerve branches that arise near the greater sciatic notch,
course within connective tissue adherent to the parent trunk
then course away approximately 3-4 cm. above the hip joint level.
The articular branch courses over the deep gluteal muscle and
enters the dorsal aspect of the hip joint.
Review of the Literature (Knee or Stifle)

Both of the texts by Gardner et al. (5) and Gray (10) similarly describe the joint capsular nerve distribution to the knee joint of man. Both state that fibers which pass to this joint arise from obturator, saphenous, femoral, tibial, and peroneal nerves. Gray's text exemplifies the level of detail in human literature of the articular neurology of the knee. It describes the capsular supply in the following manner.

The articular branch from the obturator nerve arises from the posterior branch of the obturator nerve which is supplying motor fibers to adductor magnus and brevis muscles. The articular branch descends through the adductor muscles and popliteal region with the femoral vessels, and pierces the caudomedial aspect of the fibrous joint capsule, termed the oblique popliteal ligament.

The saphenous nerve supplies a twig to the medial aspect of knee joint. This branch arises with or near the origin of the branches which contribute to the subsartorial and patellar plexuses.

The femoral nerve supplies three articular branches to the knee. These arise as twigs from the motor nerve branches which supply the three vastus muscles of the quadriceps femoris group. These twigs are described as supplying the craniomedial and craniolateral aspect of the joint capsule.
The tibial nerve is described as supplying three branches to the knee joint. These branches course satellite to the genicular branches of the popliteal artery and enter the caudomedial aspect of the fibrous capsule.

Cray (10) describes three branches of the common peroneal nerve which innervate the knee. The two proximal branches arise from the common peroneal or the distal portion of the sciatic nerve. These branches course with the proximal lateral genicular branches of the femoral artery and enter the caudolateral aspect of the joint capsule. The third branch arises from the common peroneal nerve near its division into superficial and deep branches. This branch courses proximally with the recurrent tibial artery and enters the cranial aspect of the joint capsule.

As stated before, the preceding description of articular nerve distribution is an example of the thoroughness that should exist in veterinary literature. A survey shows that such is not the case. There is no reference to stifle joint capsular innervation of the horse in Sisson (19), Taylor (20), or Rooney (17). Ellenberger and Baum (3) cite Ghetie's (7) work on the sensory innervation of the equine rear limb joints. The text describes branches of the tibial and saphenous nerves which supply the stifle joint capsule. The branch from the tibial nerve is described as arising at the level of the popliteal lymph node near the origin of the caudal femoral vessels. The branch passes between the
biceps femoris and semitendinosus muscles, between the medial head of gastrocnemius and superficial digital flexor muscles to arrive at the lateral femorotibial joint sac, under the lateral collateral ligament.

The saphenous nerve is reported to dispatch an articular branch to the femoropatellar and medial femorotibial sacs of the stifle joint. This branch is described to arise from the saphenous nerve 6-10 cm, from the origin of saphenous from the femoral nerve. There is no mention of capsular supply by obturator, femoral, or peroneal nerves.

Nickel, Schummer and Seiferle's text (15) also describe only fibers of tibial and saphenous nerves as supplying the stifle joint. Their description is very similar to that of Ghetie.

Hoffman (12) described a branch of the obturator nerve that joins the descending genicular branch of saphenous nerve. The article details the obturator branch as coursing distally along the cranial margin of the adductor longus muscle and anastomosing with the genicular branch of the saphenous in the fatty tissue adjacent to the femoral artery.

In brief, the descriptions in the literature, concerning the equine knee or stifle innervation, are limited to saphenous, tibial and obturator nerves. The question remains concerning femoral and peroneal nerve supply of the stifle joint.

Femoral and peroneal nerves have received some attention by investigators working on the knee or stifle joint of other
domestic animals. Ghoshel and Getty (8) studied the leg and pes of the ox, sheep and goat. Although their attention was directed below the level of the stifle, they described a twig arising from the peroneal nerve that ramified in the lateral aspect of the knee joint capsule.

Gigov (9) stated in his work in cattle that the knee joint capsule received nerve fibers from the saphenous, tibial and peroneal nerves. The saphenous articular branches are distributed to the medial aspect of the femorotibial sac and medial collateral ligament. Tibial branches are described as arising 5-6 cm. above the level of the joint, coursing toward and ramifying in the caudal aspect of the knee joint capsule. Peroneal articular branches are described which enter the lateral and craniolateral aspect of knee joint.

Gardner (6) performed studies on the feline knee joint which required him to ascertain the distribution of most articular branches. He discovered branches of femoral (and saphenous), tibial and common peroneal nerves that supplied the knee joint capsule. He stated that no determination of obturator nerve involvement was made in this investigation, leaving that question open.
Materials and Methods

The rear limbs of three ponies and three horses were dissected. Subjects 1, 2 and 3 were mixed breed ponies. Number 1 was a nine year old, approximately 42 inch brown mare. Number 2 was a nine year old, approximately 45 inch bay gelding. Number 3 was a four year old, approximately 40 inch brown gelding. The ponies were not weighed but all were of average weight condition ranging from 300 to 350 pounds.

Subjects 4, 5 and 6 were horses of mixed saddle breeding. Number 4 was a seven year old, approximately 1000 pound bay gelding. Number 5 was an eleven year old, approximately 1100 pound brown gelding. Number 6 was a seven year old, approximately 800 pound chestnut gelding. All of the animals were in good health, sound, and without gross abnormalities in features and gait.

The subjects were anesthetized by the intravenous administration of chloral hydrate. Euthanasia by rapid exanguination was accomplished by isolating and cannulating the common carotid artery. The subjects were euthanatized as needed to allow the use of fresh tissue for all dissections. The caudal part of the trunk and the rear limbs were removed at the level of the third or fourth lumbar vertebra. The pelvis was divided in the median plane with one limb and pelvic portion being immediately dissected, while the second half was placed in cold storage. The second portion was dissected as fresh tissue immediately following dissection of the first.
The nerves were traced by gross dissection techniques and with the aid of a dissecting microscope (a). The finer nerve branches were observed by staining, using .025% osmic acid solution. A few drops placed on the tissue would afford a good immediate contrast as the fatty and connective tissue would darken leaving the nerve branch a grey-white contrast. After 15 or 20 minutes the axons within the epineurium and perineurium would darken if excess osmium remained on the tissue.

The investigation was directed to all of the nerves that supplied motor fibers to any muscles that acted upon the hip and/or knee (stifle) joints. Their trunks were isolated at the level of the lumbosacral plexus and all of the muscular and sensory branches that coursed near the joint were dissected.

(a) Bausch and Lomb Co. (objectives of 0.7-1.5-2.0 with x15 eyepieces)
Results


a) Femoral nerve (Figure 1). In all dissections the femoral nerve was found to originate from the ventral branches of the caudal lumbar spinal nerves, in the fascia dividing psoas major and psoas minor muscles. It arises somewhat in common with the obturator nerve, both receiving a vast majority of their fibers from L4, 5, 6 spinal nerves. The femoral nerve courses caudoventrally between the psoas muscles, then curves ventrally and passes lateral to the tendon of insertion of the psoas minor muscle on the ilium. It then leaves the abdominal cavity by passing with the iliopsoas muscle through the neuromuscular canal behind the inguinal ligament. The saphenous nerve will arise from the femoral nerve within, or 1 to 2 cm. above, the canal.

In all subjects the femoral nerve gave rise to one or two, 3 to 5 mm. diameter muscular branch(es) to the iliopsoas muscle. The nerve(s) coursed laterally from the femoral nerve above the level of origin of the saphenous and ramified in the iliacus and psoas major muscles. In all subjects, except pony #2, the muscular branches which coursed distally in the caudal portion of iliacus m. dispatched filaments to the hip joint capsule. In horse #5 an additional articular branch arose from the femoral nerve in the neuromuscular canal. This 1 mm. diameter branch coursed caudally along the medial surface of the iliopsoas m. and terminated in the joint capsule.
The articular branches of the iliopsoas muscular nerves ranged from 0.1 to 0.5 mm. in diameter and they passed out of the muscle belly where it crossed the craniocentral aspect of the hip joint capsule. The nerve fibers terminated in the fibrous joint capsule and the iliofemoral capsular ligament.

Gross dissection of pony #2 did not reveal articular branches from the iliopsoas muscular branches. The femoral nerve did however supply the joint capsule. A 1.0 mm. diameter articular branch arose in the fatty connective tissue at the margin of rectus femoris and vastus medialis muscles, where the femoral nerve enters the quadriceps femoris group. This branch coursed caudodorsally into the craniocentral aspect of the joint capsule. The area of distribution was similar to the previously mentioned femoral branches.

No other variations or branches of femoral or saphenous nerves were found to be related to the hip joint capsule. The femoral nerve ramified in the quadriceps femoris muscles, to be discussed further in Part 2. The saphenous nerve continued onto the thigh supplying sartorius and pectineus muscles and cutaneous branches to the medial aspect of the thigh. The saphenous articular branch which passed to the stifle, (see Part 2) provides a 0.5 mm. diameter nerve that passes over the distomedical aspect of the femoral insertion of the pectineus muscle and enters the nutrient foramen of the femur.
b) **Obturator nerve** (Figure 4). The nerve passes beneath the pubic origin of the internal obturator muscle to arrive at the cranial margin of the obturator foramen. As it passes through the foramen it divides into cranial and caudal branches. The caudal branch courses through the obturator externus muscle, supplying it with motor fibers, and ramifies in the adductor femoris muscle. A 0.5-1.0 mm. diameter articular nerve arose from this branch in ponies #1 and 2, and horses #4 and 6. It coursed laterally in the intramuscular fascia of the obturator externus muscle ending in branches which supplied the ventral part of the joint capsule. The cranial branch of the obturator nerve either passes through, or around the cranial margin of the obturator externus muscle and extends distally in the fascia dividing pectineus and adductor longus muscles. In pony #3 a single 0.5-1.0 mm. diameter articular nerve arose from the cranial branch at or just below the level of the obturator externus muscle. In one case, horse #5, there were two articular nerves, both of which passed from the cranial branch of the obturator nerve. The articular nerve(s) which pass from the cranial or caudal obturator branches, course laterally at first in the fascia of the obturator externus muscle, then in relation to the caudal aspect of the accessory ligament of the coxofemoral joint. It gives collateral branches to the ligament and terminates in the ventral aspect of the joint capsule and pubofemoral capsular ligament. Therefore, in respect of the equine hip joint the
investigation findings show that the obturator nerve contribution is constant and similar to that described in man and ox.
c) Cranial gluteal nerve (Figures 1 and 2). This nerve was suspected of contributing to the hip joint innervation because it supplies branches to various muscles which act upon this joint. Also Gardner (5) had described such innervation in man.

The cranial gluteal nerve consists of fibers arising primarily from the ventral roots of L6 and S1 spinal nerves. The nerve, in the form of numerous branches, passes through the greater sciatic foramen in relation to the cranial margin of the sciatic trunk. Most of these branches course into the gluteal muscle mass to supply the middle and deep gluteal muscles and the cranial belly of the superficial gluteal muscle. One constant 4-5 mm. diameter branch extends laterally in the fascia dividing accessory head of middle and deep gluteal muscles. The majority of fibers of this branch terminated in the tensor fascia latae muscle. All dissections revealed a constant articular nerve that arose from this muscular branch. This articular branch which supplies the hip joint coursed caudolaterally in the fascia between middle and deep gluteal muscles, curved ventrally around the lateral margin of the deep gluteal m. and terminated in fibers that entered the capsularis coxae muscle (articularis coxae) and the cranial aspect of the fibrous joint capsule and iliofemoral capsular ligament.
d) Sciatic nerve (Figures 2 and 3). The presence of an articular branch of the sciatic nerve has been well documented in the
literature. The findings of this investigation concur with the texts. In all specimens, a 2.0-5.0 mm. diameter branch of the sciatic nerve arose from its medial surface some 2-5 cm. distal to the greater sciatic foramen. This muscular branch which supplies the obturator internus and gemellus muscles runs parallel to the course of the sciatic n., across the superficial aspect of the deep gluteal muscle. It dips into the intermuscular fascia dividing deep gluteal and gemellus muscles. At this level it dispatches fibers that pass medially through the lesser sciatic foramen and terminate in the obturator internus muscle. The nerve then courses caudolaterally between the gemellus muscle and the os coxae supplying collateral fibers to that muscle and gives rise to one to three articular branches which terminate in the dorsal and caudal aspect of the hip joint. Fibers were traced to the fibrous joint capsule and the ischiofemoral capsular ligament.
Results

Part 2. Stifle Innervation.

a) Femoral nerve (Figures 5 and 6). There was one consistent branch of the femoral nerve that was found to ramify in the femoropatellar aspect of the stifle. This branch arose at the level where the femoral nerve entered the quadriceps group, at the margin of rectus femoris and vastus medialis muscles. In most cases this 1.0-2.0 mm. diameter branch passed distally in the belly of the rectus femoris muscle to a point approximately 3-5 cm. above the patella. At this level it would leave the muscle belly and continue distally to the patella in the fascia dividing rectus femoris and vastus medialis muscles. The course of this nerve varied slightly in subjects #1 and 3. In the left limb of #1 and the right limb of #3 this articular branch passed distally entirely within the fascia separating rectus femoris and vastus medialis muscles.

The nerve divided into several branches as it proceeded in the dense fascia of the cranial surface of the patella. These terminal branchings supplied collateral fibers to the periosteum of the patella, the patellar fat pad, and fibrous capsule of the femoropatellar sac. The principle branches ramified in the lateral and middle patellar ligaments.

The other muscular branches of the femoral nerve were traced but most were found to dissipate into minute filaments
in the distal aspect of the quadriceps muscles. Further study is needed to determine whether these filaments are the efferent, alpha lower motor neurons supplying the muscle fibers or if they are sensory fibers related to capsular receptors or musculo-tendon organs.

b) Saphenous and Obturator nerves (Figures 5 and 7). These nerves will be considered together since, with one exception, articular branches from both nerves anastomose in the mid-thigh region and continue distally to supply the medial aspect of the stifle joint. The exception to these findings occurred in subject #1. In that specimen, the dissection of both hind limbs revealed no contribution of the obturator nerve to the stifle joint. All of the other subjects had a 0.5-1.0 mm. diameter articular branch that arose from the saphenous nerve at the upper one third level of the vastus medialis muscle. This branch coursed distally in the fascia dividing the vastus medialis, sartorius and pectineus muscles. The nerve somewhat parallels the course of the femoral vessels then continues craniodistally satellite to the descending genicular vessels along the medial aspect of the vastus medialis and adductor muscles. The branch of the saphenous nerve that entered the nutrient foramen of the femur, mentioned in Part 1, arose and passed caudally over the medial aspect of the distal most portion of the insertion of the pectineus muscle on the femur.
The cranial branch of the obturator nerve dispatches an articular nerve that continues distally in the fascia dividing pectineus and adductor muscles. This branch courses distally, medial to the insertion of the pectineus, and joins the saphenous articular nerve. Usually two 0.5-1.0 mm. diameter nerves arise from this anastomosis and extend toward the medial aspect of the stifle in the following manner: (1) A cranial branch courses distally along the caudal margin of the vastus medialis muscle and terminates in the medial femoropatellar ligament and joint capsule. (2) The caudal branch passes in the fascia along the cranial margin of the adductor muscle and its femoral insertion. This branch terminates in the medial femorotibial ligament and adjacent joint capsule, and in the medial aspect of the femoropatellar capsule, patellar fat pad and medial patellar ligament.

C) Tibial nerve (Figures 7 and 8). A constantly occurring branch of the tibial nerve supplied the caudal, medial, lateral and internal structures of the stifle joint. This articular branch usually arose from the cranial border of the tibial n, where it passes between the medial and lateral heads of the gastrocnemius muscle. It was always the first or most proximal of a variable number of branches to arise at this level. The 1.0-1.5 mm. diameter articular branch courses cranially in the fascia dividing superficial digital flexor and medial head of gastrocnemius muscles. Near the cranial aspect of the gastrocnemius bellies the nerve divides into two to four branches that further ramify
in the following manner: (1) A lateral branch passes into the fat and fascia on the caudolateral aspect of the femorotibial joint capsule. This branch courses around the caudolateral margin of the joint sac, where it covers the femoral condyle, giving collateral fibers to the fibrous capsule. It then extends forward and terminates in the ligamentous tissue that passes from the femur near the origin of the lateral head of gastrocnemius muscle to the surface of the lateral epicondyle of the femur.

(2) A medial branch of the articular nerve passes craniomedially along the deep surface of the medial head of gastrocnemius muscle and ramifies in the medial femorotibial sac. It distributes fibers to the fibrous capsule and terminates in the medial femorotibial ligament. (3) Middle branch(es) of the articular nerve pass forward and enter the mid-caudal aspect of the femorotibial capsule. With minor exceptions most subjects demonstrated that fibers from this branch(es) entered or terminated in the fibrous capsule, the menisci and meniscal ligaments and the cruciate ligaments.

d) Common Peroneal nerve (Figure 6). This nerve supplies 2 or 3 articular branches to the lateral aspect of the stifle. These branches arise from the cranial margin of the common peroneal where it passes in the fascia on the surface of the lateral head of the gastrocnemius muscle. These 0.5-1.0 mm. diameter nerves curve forward and then proximally to the cranial margin of the gastrocnemius belly. They then course proximally in the
fat and fascia along the muscle margin. The fibers terminate in the fibrous capsule of the femorotibial sac, the lateral femorotibial ligament and the lateral meniscus. In most cases 0.1-0.3 mm. diameter nerve filaments were observed to extend cranially and terminate in the outpouching of the lateral femorotibial sac which lines the extensor sulcus where the tendons of the long digital extensor and peroneus tertius muscles occur.
Discussion

The hip joint of all subjects received nerve fibers from the femoral, obturator, cranial gluteal and sciatic nerves. There were some variations in the manner of origin, route and numbers of branches, however, the consistent contribution of these parent nerves leads to a conclusion which reflects a part of John Hilton’s (a) law of muscle-joint relationships. His statement, cited from Cunningham’s text (2), suggests that nerves which supply muscles which act upon a joint, would also supply fibers to that joint. The fact that the caudal gluteal nerve did not supply articular branches to the hip joint capsule might question Hilton’s law. Since no information specific to this point exists, the author can only speculate on the matter.

In the embryo the development of the limb results in a distribution of adjacent spinal root nerve fibers to various trunks or nerves which pass to the limb. This interspersing of nerve fibers on the hind limb is called the lumbosacral plexus. The sciatic, cranial and caudal gluteal nerves, all branches of this lumbosacral plexus contain fibers which arise in common from spinal segments S1 and 2. Hilton’s law may imply that sensory information and motor responses regarding muscle tone, reflexes and coordination is integrated at specific spinal segments. Therefore, sensory

(a) English surgeon, 1804-1878.
information from joint capsules as well as other sources must pass to the same or adjacent cord segments which supply lower motor neurons. In this regard, and since the location of cranial gluteal and sciatic nerves are more closely related to the hip joint than is the location of the caudal gluteal, it seems likely to have all of the capsular afferent fibers in the former nerves.

The results that show the variation of the femoral nerve's supply to the iliopsoas ligament cannot be accurately explained. The filaments to the capsular ligament may have been missed on the two occasions or the anatomical variations did in fact exist. The author believes that the latter is the case.

The nerve filaments which passed to the round ligament of the hip were not investigated. The inaccessibility of it, coupled with the desire not to mutilate the more superficial capsular tissue, prompted the investigator to forego such dissections. However, in this author's opinion, based upon the relationship of round and accessory ligaments and the course of the articular nerves, that the round ligament would receive fibers from the obturator nerve. This question remains unresolved.

The pattern of stifle innervation was also very consistent with the exception of subject #1 where no obturator nerve involvement was found. However, the author cannot certainly state that such was the case. Although careful dissection was performed and alternate pathways were explored, an articular branch or branches could have been overlooked. In view of the results from the remaining dissections, that is a distinct possibility.
Finally, the question remains as to the type of nerve fibers comprising the articular branches. This matter must be resolved by more thorough histological investigations. However, on the basis of Wyke's (21) studies on the nerve supply to the feline joint capsule and Gray's (10) description of articular neurology, the type of fibers of the articular nerves can be predicted. The nerves should contain Group I, II and III fibers. Group I fibers, which range from 13-17 μ, are heavily myelinated nerves that terminate in mechanoreceptors of the joint ligaments. Group II fibers that are 6-12 μ, are myelinated nerves which terminate in mechanoreceptors of the fibrous joint capsule. Group III fibers, less than 6 μ, are the small myelinated and unmyelinated fibers of pain receptors and sympathetic vasomotor nerve endings. The pain receptors are located in all parts of the fibrous connective tissue of the joint capsule, ligaments and capsular fat pads. The vasomotor nerves are efferent fibers that follow and terminate on the capsular vessels.
Summary

The hip joint of the horse receives articular nerve fibers from the femoral, obturator, cranial gluteal and sciatic nerves. These branches are distributed to the fibrous joint capsule and associated capsular ligaments.

The knee or stifle joint of the horse is innervated by branches of the femoral, saphenous, obturator, peroneal and tibial nerves. The fibers terminate in the fibrous capsule, fat pad, patellar and collateral ligaments and the internally situated meniscal and cruciate ligaments.
Table I

Summary of the nerve supply of the hip joint.

<table>
<thead>
<tr>
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<th>SUBJECTS</th>
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<td>1</td>
</tr>
<tr>
<td>Fibrous Capsule</td>
<td>A-D</td>
</tr>
<tr>
<td>Iliofemoral Ligament</td>
<td>A,C</td>
</tr>
<tr>
<td>Ischiofemoral Ligament</td>
<td>D</td>
</tr>
<tr>
<td>Pubofemoral Ligament</td>
<td>B</td>
</tr>
<tr>
<td>Accessory Ligament</td>
<td>B</td>
</tr>
</tbody>
</table>

A=Femoral N., B=Obturator N., C=Cranial Gluteal N., D=Sciatic N.
Table II

Summary of the nerve supply of the knee (stifle).

<table>
<thead>
<tr>
<th>STRUCTURE</th>
<th>SUBJECTS</th>
</tr>
</thead>
<tbody>
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<td></td>
<td>1</td>
</tr>
<tr>
<td>Femoropatellar Sac</td>
<td>E,F</td>
</tr>
<tr>
<td>Lateral Femorotibial Sac</td>
<td>H,J</td>
</tr>
<tr>
<td>Patellar Fat Pad</td>
<td>E,F</td>
</tr>
<tr>
<td>Medial Patellar Ligament</td>
<td>F</td>
</tr>
<tr>
<td>Middle Patellar Ligament</td>
<td>E</td>
</tr>
<tr>
<td>Lateral Patellar Ligament</td>
<td>E</td>
</tr>
<tr>
<td>Lateral Femorotibial Ligament</td>
<td>J</td>
</tr>
<tr>
<td>Cruciate Ligaments</td>
<td>H</td>
</tr>
<tr>
<td>Medial Meniscus</td>
<td>H</td>
</tr>
<tr>
<td>Lateral Meniscus</td>
<td>H,J</td>
</tr>
</tbody>
</table>

E=Femoral N., F=Saphenous N., G=Obturator N., H=Tibial N., J=Peroneal N.
Figure 1

Craniocentral view of the right hip joint showing the distribution of articular branches of the femoral nerve to the hip joint capsule.

1. Iliacus m.
2. Psoas major m.
3. Gluteus profundus m.
4. Articularis coxae m.
5. Stump of the rectus femoris m.
6. Joint capsule
A. Femoral n.
A'. Muscular branch of A containing articular fibers.
A". Inconstant articular branch of A.
A"'. Inconstant articular branch of A.
B. Saphenous n.
C. Branch of cranial gluteal n. supplying articularis coxae m. and joint capsule.
Figure 2

Lateral view of the right hip joint showing the path of the articular branches of the cranial gluteal and sciatic nerves.

1. Gluteus profundus m.
2. Obturator internus m.
3. Gemellus m.
4. Joint capsule
   a. Muscular/articular branch of sciatic n.
   a'. Articular branch of a to the joint capsule.
   a''. Muscular branches of a to 2 and 2.
   b. Articular branch from b'.
   b'. Branch of cranial gluteal n. to tensor fascia latae m.
Figure 3

Caudodorsal view of the right hip joint showing distribution of the muscular/articular branch of the sciatic n.

1. Gluteus profundus m.
2. Obturator internus m.
3. Gemellus m.
4. Quadratus femoris m.
5. Hip joint capsule
A. Sciatic n.
B. Cranial gluteal n.
C. Obturator n.
a'. Articular fibers to the joint capsule.
a". Muscular fibers to gemellus m.
a"". Muscular fibers to obturator internus m.
b. Articular fibers from b'.
b'. Muscular branch of B to tensor fascia latae m.
Figure 4

Caudoventral view of the right hip joint showing the articular branch of obturator nerve to the joint capsule.

a. Obturator n.
a'. Caudal branch of a.
a". Cranial branch of a.
b. Articular branch of a" to joint capsule.
c. Proximal portion of the articular branch of a" to the knee (stifle) joint capsule.
Figure 5

Cranial view of the right knee (stifle) showing the distribution of the articular branch of femoral nerve to the joint capsule and ligaments.

1. Vastus medialis m.
2. Rectus femoris m.
3. Vastus lateralis m.
4'. Cranial ramus of the medial articular nerves to the medial patellar ligament and joint capsule.
5. Branch of the femoral n. to the middle and lateral patellar ligaments and joint capsule.
Figure 6

Lateral view of the knee (stifle) joint showing the distribution of the articular branches of the common peroneal nerve.

1. Lateral head of gastrocnemius m.
2. Long digital extensor m.
3. Lateral digital extensor m.
4. Lateral collateral ligament
5. Lateral patellar ligament
f. Tibial n.
g. Articular branch of femoral n.
h. Common peroneal n.
h'. Articular branches of h.
Figure 7

Medial view of the right femur and knee (stifle) joint showing the course and distribution of the articular branches of the saphenous and obturator nerves.

a. Obturator n.
a'. Caudal branch of a.
a". cranial branch of a.
b. Saphenous n.
c. Articular branch of a".
d. Articular branch of b.
e. Anastomosis of c and d.
e'. cranial ramus of medial articular nerve.
e". Caudal ramus of medial articular nerve.
f. Tibial n.
f'. Articular branch of f.
Figure 8

Caudomedial view of the right knee (stifle) showing the articular branches of the tibial nerve.

1. Medial collateral ligament  
f. Tibial n.  
f'. Medial branch of the articular n.  
f''. Middle branch of the articular n.  
f'''. Lateral branch of the articular n.  
m. Muscular branch of f to the popliteus m.
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