Dept. of Anatomy and Histology,
Fac. Vet. Med., Assiut University,
Head of Dept. Prof. Dr. A. Hifny.

SOME ANATOMICAL STUDIES ON THE GENUAL ARTICULATION (STIFLE JOINT) OF THE KARRADI GOAT IN MOSUL-IRAQ

(With 9 Figures)

By

I.A. IBRAHIM and M.J. YOUSIF*

(Received at 2/6/1992)

بعض الدراسات التشريحية على المفصل الركبي للماعز
الكرادي ـ في الموصل ـ العراق

إسماعيل إبراهيم ، موفق يوسف

أجري هذا البحث على المفصل الركبي الأيمن والأيسر لخمسة عشر ماعز بالغة في كلا الجنسين بالإضافة الى خمس ماعز حي ، عشرة من هذه العينات شرحت مباشرة لغرض دراسة شكل وتكوين السطوح المفصلية والأربطة التي تشارك في تكوينها ، وخمسة من الأرجل حقنت بمادة اللاتنكس الملون لوصف المحفظة المفصلية وكذلك تم تحديد الأماكن التي من خلالها حقن الحجرات المختلفة لهذا المفصل وقد تم مقارنة النتائج مع مثيلاتها من الحيوانات المختلفة وخاصة الأغنام والأبقار .

SUMMARY

In this investigation the stifle (genual articulation) of the karradi goat in Mosul-Iraq was studied in details including its formation, shape of the articular surfaces and articular capsule in addition to the site of injection. The results were discussed with those of the other domestic animals specially sheep and cattle.

INTRODUCTION

Anatomical studies of the goat are infrequent but general information concerning the goat morphology is available (GETTY, 1975 and POPESKO, 1977). The karradi goat in Mosul-Iraq characterized by well developed masculature and a relatively short bones. The available literature Lacks data about the anatomy of this animal. The present study was undertaken to provide an information about the anatomy, radiography and the site of injection of the stifle (Genual articulation) of this animal.

MATERIAL and METHODS

This work was carried out on (15) joints obtained from apparently healthy adult karradi goats of both sexes from Mosul slaughter house, as well as (5) living animals.

---

*:Dept. of Anat., Hist. and Embryology, Faculty of Vet. Med. Mosul University, Iraq.

All joints were firstly radiographed and evaluated. Ten joints of them were carefully dissected and masserated in the fresh state to study the morphological feature of the articular surfaces and ligaments and the other related structures to determine the suitable sites for injection of the different sacs of the stifle joint. The description of the articular capsule was performed on (5) joints injected with gum milk latex colured red with carmine. The living animals were injected in the previously determined sites to show the probability of success and failure in reaching the different joint cavities particularly for those of the femorotibial articulation.

The Nomenclature used in this study is that adopted by the Nomina Anatomica Veterinaria (1977) as it is possible.

RESULTS

In karradi goat, the stifle (genual articulation) is a compound one and is formed of the femoropatellar as well as the femorotibial articulations.

I- Femoropatellar articulation:

It is formed between the trochlea of the femur and the articular surface of the patella (Fig. 1/a). The trochlea consists of two slightly oblique and parallel ridges with a wide and deep groove between them. They converge slightly proximally but diverge distally. The medial ridge (Fig. 2A/1) is lower in the level than the lateral one and is much larger specially at its distal part where it continues with the medial condyle of the femur (Fig. 2A/4). The lateral ridge is separated from the lateral condyle by the extensor fossa (Fig. 3A/5).

The articular surface of the patella (Fig. 2B) is much smaller than that of the trochlea. It is completed medially by a plate of cartilage, the parapatellar fibrocartilage, which curves over the medial ridge of the trochlea. The surface is divided by a slight ridge (Fig. 2B/1) extending from the base proximally to the apex distally into a smaller lateral (Fig. 2B/2) and larger medial (Fig. 2B/3) portions.

Articular Capsule:

The articular capsule of the femoropatellar articulation in karradi goat (Fig. 7/1) is thin and capacious. Its fibrous layer is attached around the margin of the articular surfaces. It is strengthened laterally by the lateral femoropatellar ligament which is partially blended with it, while medially the fibrous layer is related to the medial femoropatellar ligament which is separated from it. The capsule pouches proximally under the quadriceps femoris muscle for a distance of 1.5 cm (Fig. 7/2) and a pad of fat separating it from this muscle. Distal to the patella the capsule is separated from the patellar ligaments by a thick pad of fat; more distally it is incontact with the femorotibial capsule. It communicates with the medial synovial sac of the femorotibial joint cavity (Fig. 7/4) by a narrow slit like opening situated at the lowest part of the medial ridge of the trochlea of the femur. There is no communication observed with the lateral synovial sac.

Ligaments:

The femoropatellar articulation presents the following ligaments:

a- The femoropatellar ligaments, medial and lateral, are two fibrous bands which reinforce the capsule on either sides. The medial femoropatellar ligmant (Fig. 5/1) is fairly distinct and is fan shaped with its wide part situated cranially. It arises from an eminence on the medial epicondyle of the femur just proximal and caudal to the medial collaterl ligament. The ligament diverge in a craniproximal direction to end on the medial border of the patella, the parapatellar fibrocartilage which attaches to it and the medial part of the cranial surface of the patella distal to its tuberosity. The lateral femoropatellar ligament (Fig. 6/1) is thiner and not distinct from the fibrous layer of the articular capsule. It is represented by a narrow band which arises from an eminence situated on the most caudal part of the lateral epicondyle of the femur proximal and caudal to the attachment of the lateral collateral ligament. From its origin this ligament passes in an oblique proximocranial direction to be attached about the middle of the lateral border of the patella.

b- The patellar ligaments: These are three bands which attach the patella to the tuberosity of the tibia. They are the tendons of insertion of the quadriceps femoris and the gluteobiceps muscles and transmit the action of these muscles to the investigated joint. The medial patellar ligament (Fig. 5/3) is fairly distinct and arises from the medial part of the cranial surface of the patella distal to its tuberosity and ventral to the attachment of the medial femoropatellar ligament, here it is covered for apart by that ligament after which it passes distally to be attached on the most proximal part of the medial surface of the tibia just ventral to the point of junction of the proximal extremity with the shaft and caudal to the tibial tuberosity.

The middle patellar ligament (Fig. 5,6/2) is avelatively long, strong, thick and broad band which extends from the cranial surface of the patela ventral to its tuberosity and passes distally in a straight manner to be attached to and covers the tibial tuberosity.

The lateral patellar ligament (Fig. 6/3) is not distinct and fuses completely with the tendon of insertion of the gluteobiceps muscle which extends from the distal half of the lateral border of the patella to the lateral surface of the tibial tuberosity.

II- Femorotibial articulation:

The femorotibial articulation in karradi goat is formed between the condyles of the femur, proximal extremity of the tibia and the interposed articular menisci between them (Fig. 1/b, Fig. 4).

The condyles of the femur are slightly oblique in direction. The lateral condyle (Fig. 3A/3, Fig. 4/4) is more larger and wider than the medial one (Fig. 3A/1, Fig. 4/3) with its articular surface is more strongly curved. The medial condyle is confluent distally with the medial ridge of the trochlea, while the lateral one is separated

from the lateral ridge by the extensor fossa (Fig. 3A/5). In addition, the articular surface of the lateral condyle presents the popliteal fossa (Fig. 3A/6) from which the oblique tendon of the popliteal muscle arises.

The proximal extremity of the tibia presents two articular eminences, the medial and lateral condyles (Fig. 3/C). Each have a somewhat saddle shaped articular surface for articulation with the corresponding condyle of the femur and meniscus. The lateral condyle (Fig. 3c/1, Fig. 4/7) is more larger than the medial one (Fig. 3c/1) and extends more caudally on the caudal surface of the proximal extremity forming an overhanging lateral and caudal margins, the lateral one presents distally a facet for articulation of the head of the fibula (Fig. 4/8). The intercondyloid eminence or spine (Fig. 3c/3) is obliquely situated and consists of a high larger lateral part and low smaller medial part. These two parts are separeted by a deep and narrow nonarticular fossa from which the cranial cruciate ligament arises. On cranial and caudal to the intercondyloid eminence are the intercondyloid fossae, the caudal one (Fig. 3c/5) is more larger and deep and to which attaches the caudal ligament of the medial meniscus. The cranial fossa (Fig. 3c/4) is represented by a small shallow non-articular depression separated cranially by the lateral part of the intercondyloid spine and in which attached the cranial ligament of the lateral meniscus. Cranial to the medial part of the intercondyloid spine of the tibia there is a small eminence for the attachment of the cranial ligament of themedial meniscus.

The two condyles of the tibia are separated caudally by a wide popliteal notch (Fig. 3c/6) on the medial side of which and incontact with the medial condyle there is a prominent tubercle (Fig. 3c/7) for the attachment of the caudal cruciate ligament. The tuberosity of the tibia has an oblique surface directedf craniodistally and is covered completely by the attachment of the middle patellar ligament.

The menisci, medial and lateral (Fig. 3B/1,2) are crescentic plates of fibrocartilage which produce congurence in the articular surface. The lateral meniscus (Fig. 3B/2) does not cover the caudal part of the lateral tibial condyle over which the tendon of origin of the popliteal muscle plays. Each meniscus has a proximal deep concave surface adapted to the condyle of the femur and a distal somewhat convex surface which fits the corresponding condyle of the tibia. The lateral border of each meniscus is very thick and convex while the medial one is very thin and concave. The cranial and caudal extremities are attached to the tibia cranial and caudal to the tibial spine by the meniscal ligaments.

Meniscal Ligaments:

Each menicus is attached cranially to the tibia by a cranial meniscotibial ligament (Fig. 3B/3, 4). The lateral one (Fig. 3B/4) is longer and broader than the medial one. It extends from the cranial extremity of the lateral meniscus to be attached in the cranial fossa cranial to the intercondyloid spine. The medial one (Fig. 3B/3) is shorter and thinner than the lateral. It extends from the cranial extremity of the medial meniscus

to attach in an eminence cranial to the cranial fossa and the cranial part of the spine of the tibia. The medial meniscus in addition is attached to the tibia by the caudal meniscotibial ligament (Fig. 3B/5) which extend from the caudal extremity of the meniscus to the caudal fossa caudal to thespine of the tibia. The lateral meniscus is attached to the femur by a meniscofemoral ligament (Fig. 4/1). This ligament is represented by a thick short flattened band which extends from the caudal extremity of the lateral meniscus. It ascends in an oblique proximal direction to be attached in a depression situated on the most caudo-medial part of the intercondyloid fossa of the femur just proximal to the medial condyle.

Articular Capsule:

The fibrous layer is attached around the margins of the femur and tibial condyles; the convex borders of the menisci as well as to the cruciate ligaments. It is thin cranially and represented only by the synovial layer while it is much stronger caudally where it is reinforced by the oblique tendon of the popliteal muscle. Laterally the articular capsule is related to the medial and lateral femorotibial ligaments.

There are two synovial Sacs with a very small communication observed between them in between the cruciate ligaments. Each of the synovial Sacs is partially divided into a proximal and distal compartments by the corresponding meniscus. The Sacs pouch proximally about 1 cm over the condyles of the femur (Fig. 7,A,B,D,6/7) but only the lateral one pouches about 1 cm distally over the lateral tibial condyle and under the popliteal muscle (Fig. 7,B,D/8). The lateral synovial Sac invests the tendon of origin of this muscle and extends into the muscular groove of the tibia (Fig. 7B,C/9) where it communicate with the synovial tendon sheath of the fibularis tertius and the extensor digitorum longus muscles (Fig. 7,B,C/10). The medial Sac communicates cranially with the synovial Sac of the femoro-patellar joint cavity (Fig. 7,A/4).

Ligaments:

There are four of these-two collateral and two cruciate. The medial collateral ligament (Fig. 5/4) is represented by a long, narrow and somewhat thick band which extands from a depression on the medial epicondyle of thefemur distal to the attachment of the medial femoropatellar ligament. It passes distally in a straight manner to be attached on the most caudal part of the medial surface of the tibia about 4 cm distal to the margin of the medial condyle of the tibia.

The cruciate ligaments are two strong rounded bands which are situated mainly in the intercondyloid fossa of the femur between the two synovial sacs. They cross each other somewhat in the form of an X and are named according to tibial attachments, cranial and caudal cruciate ligaments. The caudal cruciate ligament (Fig. 4/2) is longer and lies medial to the cranial one. It arises from a prominant tubercle situated on the medial side of the popliteal notch of the tibia (Fig. 3C/7). From its origin the caudal cruciate ligament is directed proximally and cranially to be inserted in a depression situated in the most cranial part of the intercondyloid fossa of the femur. The

cranial cruciate ligament is more shorter than the caudal one. It arises from the intercondyloid fossa (central fossa) on the tibial spine and extends proximo-caudally to be attached on the lateral wall of the intercondyloid fossa of the femur.

Site of injection:

The most convenient injection site for the femoropatellar joint is in the proximal third of the cleft bounded whether by the medial or lateral and middle patellar ligaments. The needle is introduced obliquelly and proximally under the patella for a depth of 2 cm. In addition to the afore mentioned sac there are 2 communicating femorotibial sacs, medial and lateral, making injection into the lateral sac is best accomplished at the most distal part of the lateral patellar ligament. The needle is introduced obliquelly and proximally for 1 cm. At the same level on the medial side an injection can be made into the medial femorotibial sac. The femorotibial sacs can be injected another technique. For injection of the lateral femorotibial sac (Fig. 9/B), the needle is directed obliquelly and proximal to the head of the fibula and introduced for about 1.5 cm toward the apex of the patella. For injection of the medial synovial sac (Fig. 8/B) of the femorotibial articulation the needle is directed obliquely and proximally and introduced for about 1 cm in the triangular area limited by the medial patellar ligament medially, the medial collateral ligament caudally and the medial femoropatellar ligament proximally. Also for injection of the femoropatellar joint cavity medially and proximally to the medial femoropatellar ligament about the middle of the patella (Fig. 8/A). The needle is introduced obliquely and distally under the patella for 2 cm. A similar technique can be applied on the lateral surface to inject the joint cavity (Fig. 9/A).

DISCUSSION

In karradi goat, the trochlea of the femur consists of two slightly oblique and somewhat parallel ridges with a wide and deep groove between them, the medial ridge is lower in level than the lateral one. According to GETTY (1975) the ridges of the trochlea in ruminants are less oblique than in horse and converge very slightly distally. However, in the present study the ridges are converge veryslightly proximally but diverge distally.

The articular surface of the patella in the present investigation is divided by an slight ridge into a smaller lateral and larger medial portions. This is in agreement with that described in sheep by MAY (1970), however GETTY (1975) claimed that the articular surface of the patella in ruminants is convex from side to side and is nearly straight in the vertical direction.

According to MAY (1970) in the sheep, the condyles of the femur are more oblique than they are in the dog with the intercondylar nonarticular region narrower. He added that, the boundaries of these condyles are not as prominant and are thinner especially the lateral boundry with a resulting wider articular surface. DYCE/WENSING (1971) in the ox stated that the femoral condyles are spirally curved in sagittal section

and although flatter infront do not establish extensive contact with the gently undulating condyles of the tibia in any position of the joint. In this connection, the lateral condyle in this study is more larger and wider than the medial one with its articular surface is more strongly curved.

The medial and lateral mensci in karradi goat correspond to those in other domestic animals in that they are crescentic plates of fibrocartilage which produce congurence in the articular surfaces and the absence of the proximal tibial attachement of the caudal border of the lateral meniscus as well as the presence of the strong meniscofemoral ligament which serves as a true caudal attachment of the lateral meniscus as reported by GLUHBEGOVIC (1972) and GLUHBEGOVIC/HADZISELIMOVIC (1970) in mammals and GLUHBEGOVIC/ARNAUTOVIC (1975) in camel.

According to GETTY (1975) the articular ligaments of the goat are generally stronger and more easily blineated than those of the sheep. MAY (1970) in sheep describes the patellar ligament as a strong band extending from the apex of the patella to the proximal end of the crest of the tibia. He did not differentiate it into its three portions. However, in agreement with that pointed by GETTY (1975) and POPESKO (1977) the patellar ligaments in the goat are the lateral, middle and medial ones. As described in our study and in agreement with that reported by GETTY (1977) in ruminants the middle patellar ligament is not sunken as there is no groove on the tuberosity of the tibia where it is attached. The lateral patellar ligament fuses completely with the tendon of insertion of the gluteobiceps muscle as that mentioned in sheep and ox by GETTY (1975) and in sheep by MAY (1970). The point of attachment of the medial collateral ligament in karradi goat is on the medial surface of the tibia 4 cm distal to the medial condyle. In this connection and in the sheep MAY (1970) revealed that this ligament is attached distal to the margin of the medial condyle of the tibia.

In this investigation only the medial synovial sac of the femorotibial articulation is connected with the femoropatellar joint while the lateral one extends into the muscular groove of the tibia under the muscles preneous tertius and extensor digitorum longus where it is connected by the tendon sheath. On the other hand and according to GEETY (1975) in ruminants there is a considerable communication between the femoropatellar and the medial femorotibial joint cavities. He added that, this is similar to that in the horse but is wider, however in the horse as stated by the above mentioned aurthor the joint cavity of the femoropatellar articulation is the most extensive in the body and it is usually communictes with the medial sac of the femorotibial joint cavity by a slit- like opening situated at the lower part of the medial ridge of the trochlea. This is in a greement with that described in this study and in sheep as pointed by MAY (1970). The communication of the femoropatellar joint cavity with the lateral sac of the femorotibial articulation which described in horse by GETTY (1975) was not observed in this investigation as well as in the sheep as mentioned by MAY (1970) and POPESKO (1977). According to DYCE and WENSING (1971) the

cavities of the three joints which together make up the stifle in ox generally communicate and an injection into any one will spread through the whole system.

The external landmarks determined for injection or aspiration of the stifle joint in our work bear great resemblence to those mentioned by DYCE and WENSING (1971) in ox, IBRAHIM et al. (1981), ATTIA and OTHMAN (1986) in donkey. However, the other methods described in our study were not described by any of the above mentioned aurthors.

REFERENCES

Attia, M. and Othman, M. (1986): Pilot studies on the technique for arthrocenteses and intra-articular and intra-bursal injection in donkey. Assiut Vet. Med. J. Vol. 17, No. 31: 1-7.

Dyce, K.M. and Wensing, C.J.G. (1971): Essentials of bovine anatomy. The state university, utrecht. The Netherlands, 187-194.

Getty, R. (1975): The anatomy of the domestic animals. Vol. 1. W.B. Saunders Co. Philadephia London. 364-370, 790. 1st ed.

Gluhbegovic, N. (1972): Über die Bänder des lateralen meniskus einiger wildtiere. Verh. der. Anat. Ges auf der 66. Versammlung in Zagreb Vom. 1 bis 4. Juni 1971. Ergänzungshelf Zum 130. Band des Anat. an Z., S. 505-516. Cited by Gluhbegovic, N. and Arnautovic, I. 1975.

Gluhbegovic, N. und Arnautovic, I. (1975): Mensici of the camel Knee joint. folia anatomica iugoslavica, Vol. 6., Str. 169-176.

Gluhbegovic, N. Und Hadzielimovic, H. (1970): Beitrag Zu den Vergleichenden anatomischen undersuchungen der Bänder des lateralen meniskus. Verh. der Anat. Ges. auf der 64. Versammlung in Hamburg/Soar Vom. 30. Marz bis 2. April 1969. Erganzungsheft Zum 126. Band des Anat. Anz. S. 565-574. Cited by Gluhbegovic, N. and Arnautovic, I. 1975.

Ibrahim, I.S.; Ahmad, S.A.; Osman, F.A. and El-Keiy, M.T. (1981): Anatomical and clinical Aspect on patellar luxation in donkey. J. Egypt. V.M.A., 41(2): 87.

May, D.S. (1970): The Anatomy of the Sheep 3rd. Edition University of Queensland Press., pp. 304-306.

Nomina Anatomica Veterinaria (1977): International commitee on Veterinary Anatomical Nomenclature Ithaca, New York.

Popesko (1977): Atlas of Topographical Anatomy of the Domestic Animals Vol. 3. 2nd Edition. W.B. Saunders Co. Philadephia & London.

LEGENDS

Fig. 1: Lateromedial radiograph of right stifle (genual articulation) of Karradi goat throughbred colt (right) and labeled tracing (left)

a- Femoropatellar articulation. **b-** Femorotibial articulation.

Fig. 2: Bones of the right stifle of karradi goat (Femoropatellar articulation).
A- Trochlea of the femur: 1- Medial ridge. 2- Lateral ridge. 3- Medial condyle. 4- Connection between 1 and 3.
B- Articular surface of the patella: 1- Slight ridge. 2- Smaller part. 3- Larger part. 4- Base. 5- Apex.

Fig. 3: Bones of the right stifle of karradi goat (Femorotibial articulation).
A- Distal extremity of the femur: 1- Medial condyle. 2- Medial ridge. 3- Lateral condyle. 4- Lateral ridge. 5- Extensor fossa. 6- Popliteal fossa. 7- Intercondyloid fossa.
B- Menesci: 1- Medial meniscus. 2- Lateral meniscus. 3- Cranial ligament of medial meniscus. 4- Cranial ligament of lateral meniscus. 5- Caudal ligament of medial meniscus. 6- Menisco femoral ligament of lateral meniscus.
C- Proximal extremity of the tibia: 1- Medial condyle of the tibia. 2- Laterl condyle of the tibia. 3- Intercondyloid spine. 4- Cranial fossa.

Fig. 4: Right stifle of karradi goat, caudal riew. (Femorotibial articulation)
1- Meniscofemoral ligament. 2- Caudal cruciate ligament. 3- Medial condyle of the femur. 4- Lateral condyle of the femur. 5- Medial meniscus. 6- Lateral meniscus. 7- Lateral condyle of the tibia 8- Head of the fibula.

Fig. 5: Right stifle of karradi goat, Medial view.
1- Medial femoropatellar ligament. 2- Middle patellar ligament. 3- Medial patellar ligament. 4- Medial collateral ligament: (a) Patella. (b) Femur. c- Tibia. d- Medial meniscus.

Fig. 6: Right stifle of karradi goat, lateral view.
1- Lateral femoropatellar ligament. 2- Middle patellar ligament. 3- Lateral patellar ligament. 4- Lateral collateral ligament: (a) Patella. (b) Femur. (c) Tibia. (d) Lateral meniscus.

Fig. 7: Latex cast of the articular capsule of left stifle of karradi goat.
A- Medial view B- Lateral view.
C- Cranial view. D- Caudal view.
1- Articular capsule of the femoropatellar articulation. 2- Proximal pouch of 1. 3- Medial synovial sac of the femorotibial articular capsule. 4- Connection between 1,3. 5- Lateral synovial sac of the femorotibial articular capsule. 6- Proximal pouch of 3. 7- Proximal pouch of 5. 8- Distal pouch of 5. 9- Extension of 5 to the tibia. 10- Tendon sheath of muscles extensor digitorum longus and fibularis tertius.

Fig. 8: Lateromedial radiograph of the right stifle of karradi goat showing.
A- Site of injection of femoropatellar articulation.
B- Site of injection of medial synovial sac.

Fig. 9: Mediolateral radiograph of the right stifle of karradi goat showing.
A- Site of injection of femoropatellar articulation.
B- Site of injection of lateral synovial sac.

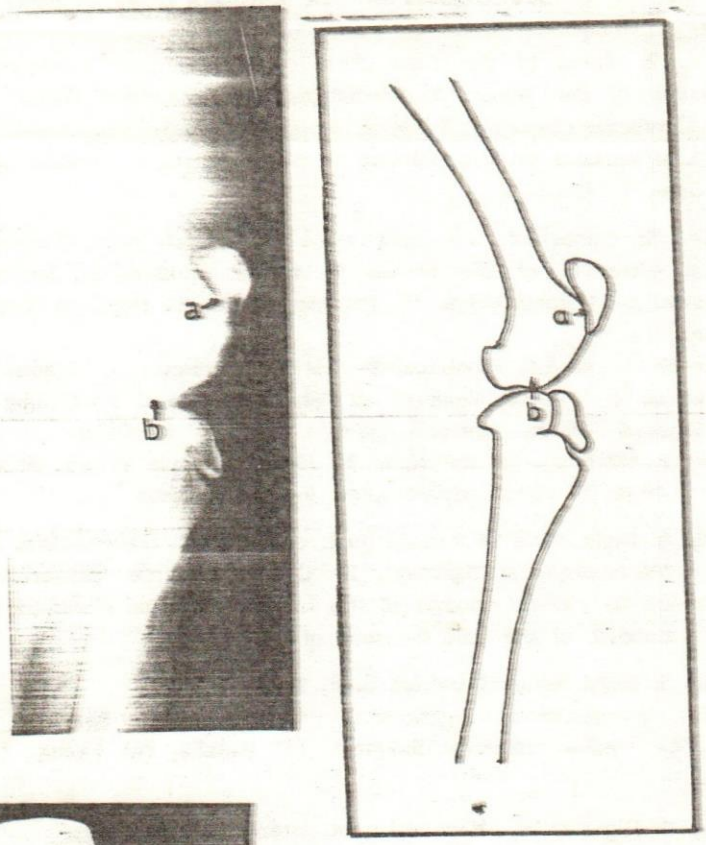


Fig. 1

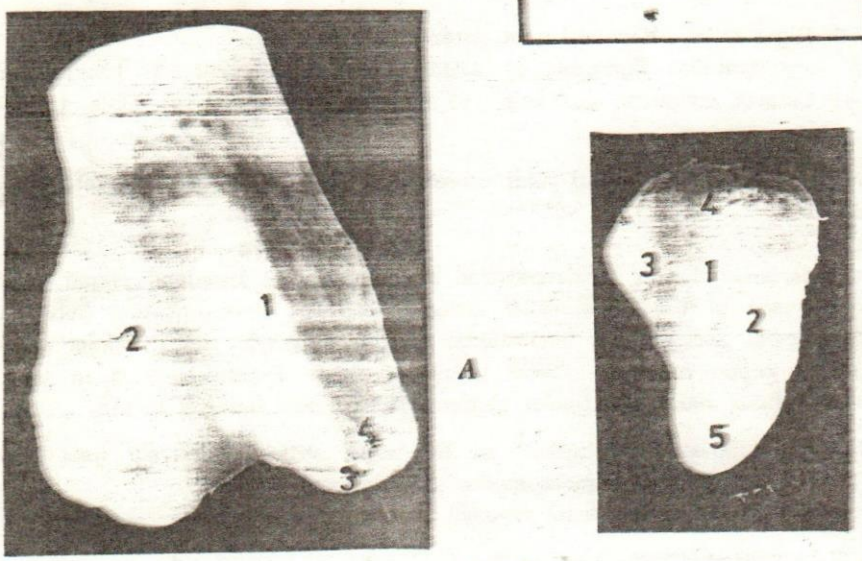


Fig. 2

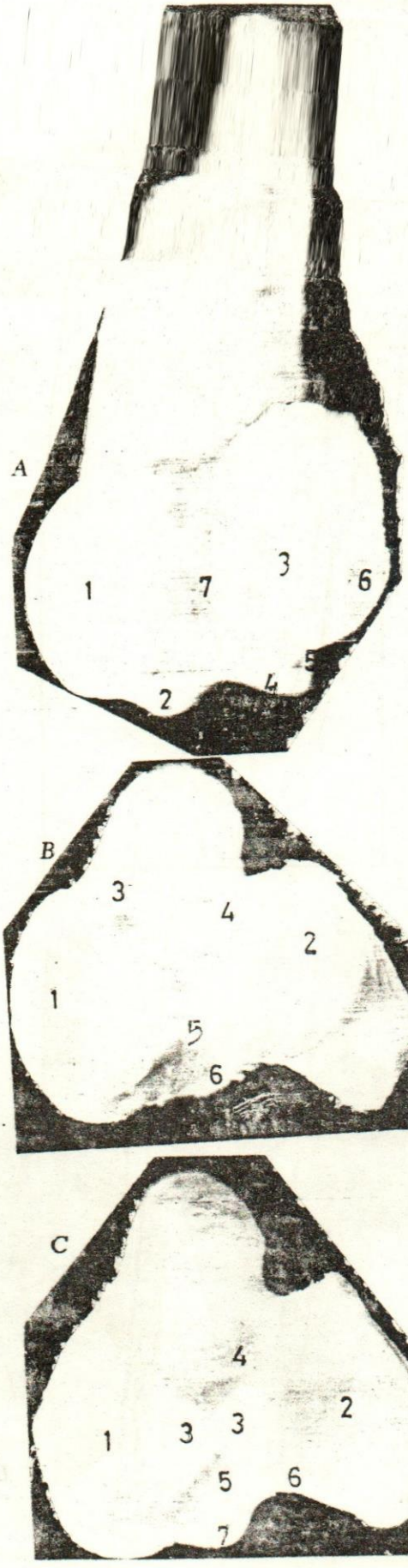


Fig. 3

Fig. 4

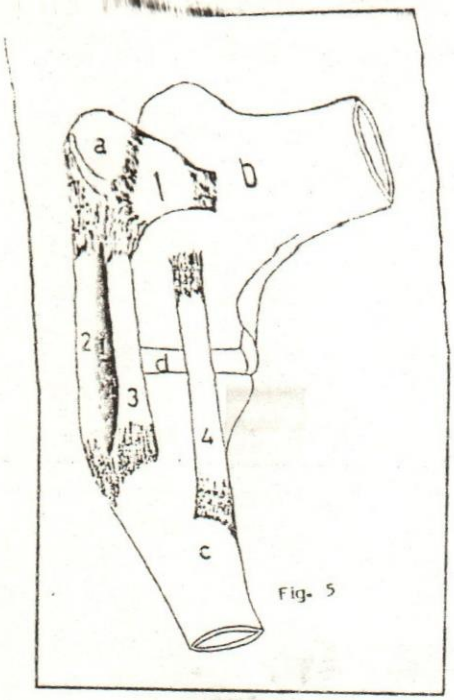


Fig. 5

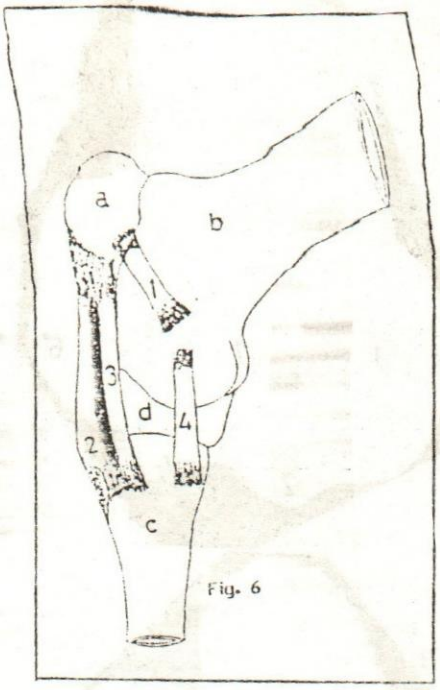


Fig. 6

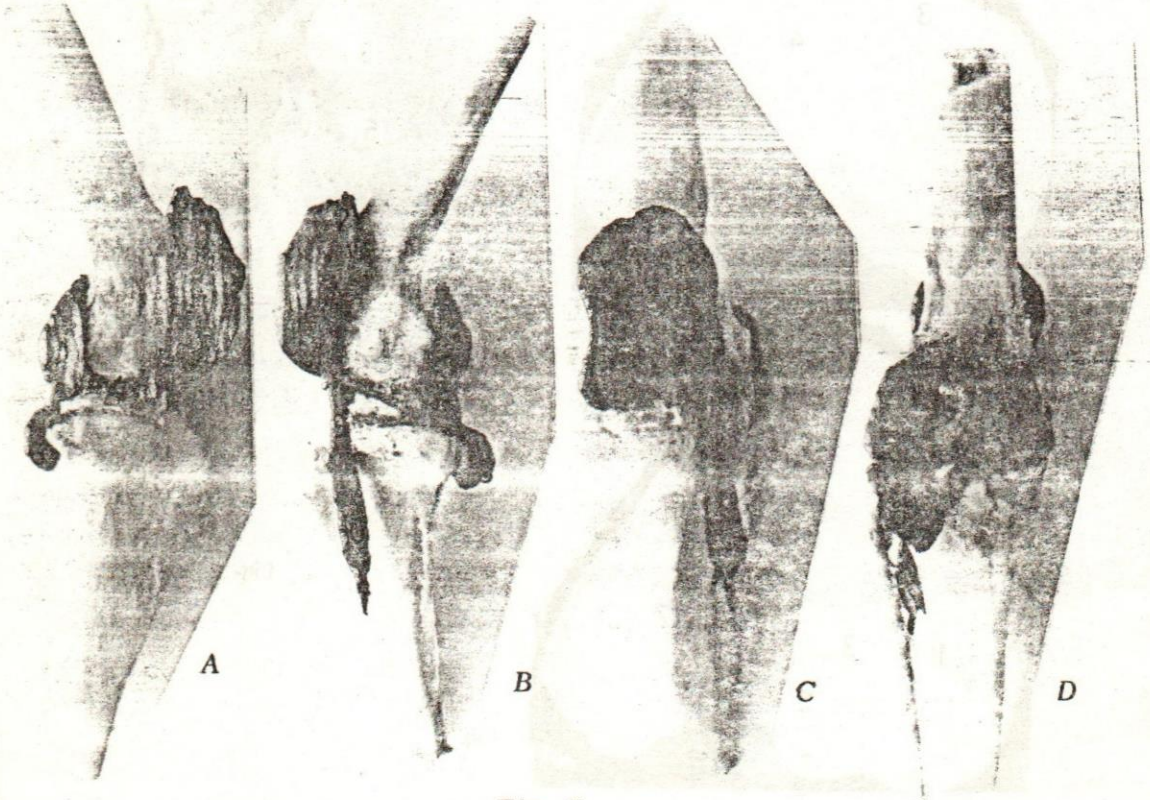


Fig. 7

STIFLE JOINT OF THE KARRADI GOAT IN IRAQ

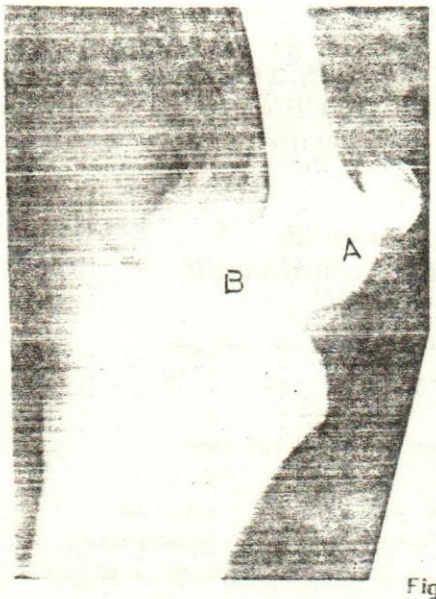
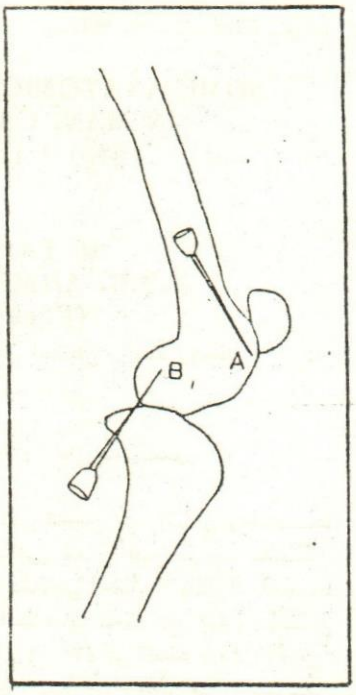


Fig. 8



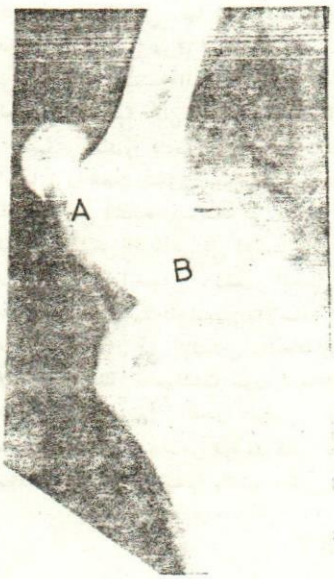


Fig. 9