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Morphological Features of Articular Surfaces of Femoropatellar Joint in Pre and Post Natal Stages of the Buffalo (*Bubalus bubalis*)

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ABSTRACT

Femoro-patellar joint from different age groups of buffalo were collected which were divided into four groups viz., Group I (Prenatal), Group II (young 0-3yrs), Group III (3-6yrs) and Group IV (>6yrs) and morphometric measurements were recorded and subjected to statistical Analysis. Length of the lateral trochlear ridge of femur increased significantly ($P \leq 0.01$) from 3.70 ± 0.73 cm in specimens of group I to 12.86 ± 0.23 cm in group IV in contrast to medial trochlear ridge showed a significant increase from group I (4.79 ± 0.59 cm) to group III (12.60 ± 0.40 cm) only beyond which difference in growth in length was insignificant.

Key words: *Femoro-patellar joint, Lateral Ridge, Medial Ridge, Post natal buffalo*

INTRODUCTION

The stifle joint of animals is the most versatile synovial (diarthrodial) and modified hinge joint joint which has great importance in animal's locomotion because the pelvic limbs act as a propeller to the body[1,2,9] which consists of compounded paired femorotibial, single femoropatellar and tibiofibular articulations. Of which, the former two are clinically important articulations, which are inter dependent wherein femoro-patellar joint constituted by trochlea of femur and patella[1,4,5,6] in domestic animals and in buffalo[8] which is well anchored by medial parapatellar cartilage and femoro-patellar ligaments giving necessary sliding movements which rely on movements of femur and tibia.

MATERIAL AND METHODS

Intact stifle joint specimens of twenty four (24) apparently healthy buffaloes and fetuses were procured from either hind limb by a cut at the level of distal and proximal thirds of femur and tibia respectively. Age determination of the post natal specimen was done by using the dental formula of the slaughtered animals as per (3) and by employing Soliman formula (7) for prenatal age estimation.

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The collected specimens were divided into four groups viz., Group I (Prenatal), Group II (young 0-3yrs), Group III (3-6yrs) and Group IV (>6yrs).

Stifle joint specimens of all groups were carefully dissected to study all its constituent ligaments and articular ends. Immediately various gross morphological features were studied and morphometrical values recorded with use of thread, metric scale and digital Vernier caliper.

The recorded values were incorporated in SPPSS 17 programme for analysis of variance or ANNOVA.

RESULTS AND DISCUSSION

In the present study, **c**ranial aspect of the distal end of femur consisted of a trochlea consisting of a groove and flanked by two ridges *viz.*, medial and lateral (Figs. 1,3, 4 and 5). These ridges were slightly oblique in their longitudinal axis (Figs. 1 and 5). In fresh state, the femoral trochlea in specimens of group I were smooth, shiny white with slight reddish tinge (Figs. 1 and 3). Whereas, in groups II and III, it was even surfaced and shiny white in color (Figs. 1 and 3). In case of aged specimens from group IV, the trochlear surface showed signs of wear and tear and was slightly eroded in the groove. Edges of both the ridges were slight yellowish in color (Fig. 5). Among the two ridges, the medial one was conspicuously broader and wider than the lateral one and was placed at a higher level (Figs. 1 and 5). The medial ridge at its proximal end was stouter and had leveled abruptly on the distal epiphysis of femur (Fig.5). Distally both the ridges joined their respective condyles (Figs. 3 and 4).

Vertical length of the lateral trochlear ridge increased significantly ($P \leq 0.01$) from 3.70 ± 0.73 cm in specimens of group I to 12.86 ± 0.23 cm in group IV. The length of the medial trochlear ridge showed a significant increase from group I (4.79 ± 0.59 cm) to group III (12.60 ± 0.40 cm) only (Table 1). Beyond this stage, difference in length of the trochlear ridge was insignificant. The width was measured at three places ~~of~~ in trochlear ridge. It showed a significant increase from group I to IV in case of lateral trochlear ridge width (Table.1).

The mean thickness of the lateral ridges of group IV was 11.83 ± 0.30, 11.35 ± 0.54 and 9.82 ± 0.10 cm in three areas. In medial trochlear ridge significant thickness was recorded at proximal and distal end in group III (17.88 ± 0.84 and 8.58 ± 0.46 cm) and 6.90 ± 1.23 and 2.84 ± 0.56 cm in group I. Width of the medial ridge increased significantly from group I to II and from group III to IV (Table 1). Numerical value of thickness of medial ridge was highest at proximal end (22.94 ± 2.00 mm) followed by mid part (15.9 ± 2.69 mm). Lowest thickness was noticed at the distal end of the ridge.

Other articulating bone ~~is~~ was the largest sesamoid *i.e.*, the patella, which in all four groups was observed as a triangular prism shaped structure with a base and apex. Cranial or dorsal surface was rough but convex from all sides for the attachment of muscle. Caudal or ventral articular surface was smooth and glistening in appearance and was divided into almost equal halves into medial and lateral surfaces by a blunt low leveled ridge (Fig. 2). Articular surface of the patella in group I was creamy white and shiny in appearance. In post natal groups II, III and IV, the articular surface was white (Fig. 2). Medial articular surface was attached by a thick piece of cartilage called as 'parapatellar' cartilage on the entire length of medial border. This helped in covering the deficit of medial surface to conform to the medial trochlear ridge of femur (Fig. 2). The apex of the patella was slightly pointed and curved posteriorly. Similar opinion was given in cattle and horse [1,4,5] and in buffalo calves [8]. The articular surface and length of the patella increased significantly ($P \leq 0.01$) from group I to group IV specimens. The length of patella and width of articular surfaces (Lateral and medial) measured in group IV is 07.12 ± 0.46 cm and 2.68 ± 0.12 and 4.03 ± 0.09 mm respectively (Table 2).

Table 1: Morphometric increase of femoral trochlear ridges from group I to group IV

S No	Trochlear ridges		Group I		Group II		Group III		Group IV	
			Mean	SD	Mean	SD	Mean	SD	Mean	SD
1	Lateral	L	3.70[a]	0.73	7.55[b]	0.47	9.63[c]	0.65	12.86[d]	0.23
		W1	2.79[a]	0.51	6.56[b]	0.40	9.21[c]	0.93	11.83[d]	0.30
		W2	2.55[a]	0.48	6.33[b]	0.35	9.12[c]	0.92	11.35[d]	0.54
		W3	2.24[a]	0.30	5.81[b]	0.81	9.07[c]	0.95	9.82[d]	0.10
2	Medial	L	4.79[a]	0.59	10.35[b]	0.45	12.60[c]	0.40	12.84[c]	0.14
		W1	6.90[a]	1.23	15.20[b]	1.12	17.88[c]	0.84	22.94[c]	2.00
		W2	4.81[a]	0.71	11.05[b]	1.68	11.55[b]	0.91	15.90[c]	2.69
		W3	2.84[a]	0.56	7.81[b]	0.84	8.58[c]	0.46	9.19[c]	0.18

L – Length (cm) and W1/W2/W3– width (in mm) at proximal, middle and distal aspect oftrochlear ridges; * Means with similar superscript within a row do not differ significantly ($p \leq 0.05$).

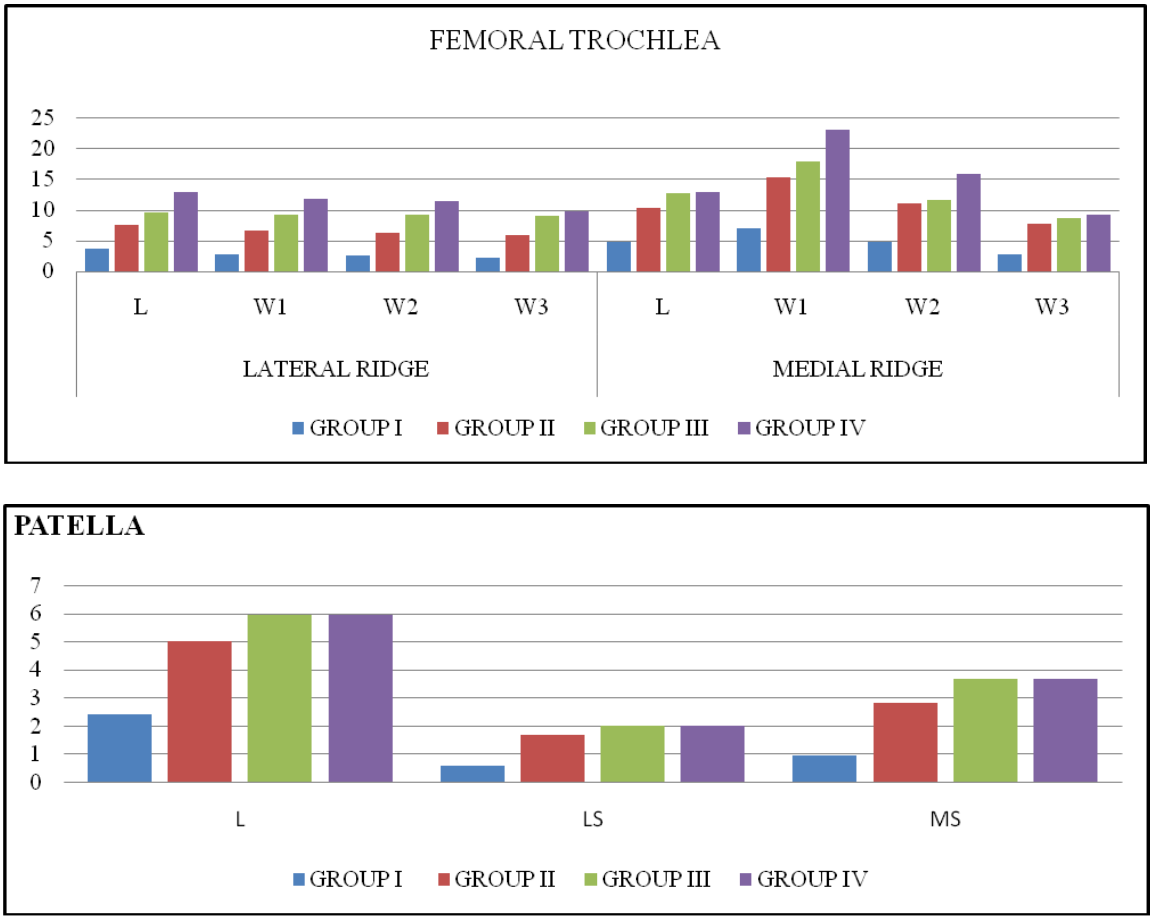
Table 2: Morphometric growth of articular surfaces of patella from group I to group IV

S No	Articular surfaces		Group I		Group II		Group III		Group IV	
			Mean	SD	Mean	SD	Mean	SD	Mean	SD
1	Patella	L	2.40[a]	0.57	5.02[b]	0.35	5.95[c]	0.26	7.12[d]	0.46
		LS	0.56[a]	0.27	1.67[b]	0.05	2.00[c]	0.21	2.68[d]	0.12
		MS	0.94[a]	0.59	2.82[b]	0.08	3.68[c]	0.08	4.03[d]	0.09

L – Length of patella (cm), LS – lateral articular surface and MS – medial articular surface (cm)

* Means with similar superscript within a row do not differ significantly ($p \leq 0.05$).

Plate 1: Morphometrical changes in stifle joint Femoral Trochlea and Patella from Prenatal Stage (Group I) to Postnatal Stage (Group IV)



Morphometrical changes in stifle joint Femoral Trochlea and Patella from Prenatal Stage (Group I) to Postnatal Stage (Group IV)

L – Length, (in cm)
LS – Lateral articular surface of Patella, (in cm)
MS – Medial articular surface of Patella, (in cm)
W1 – width at proximal aspect of each femoral ridge (in mm).
W2-width at middleaspect of each femoral ridge (in mm).
W3-width at distal aspect of each femoral ridge (in mm).

Fig. 1:

Anterior view photograph of anterior aspect of distal extremity of femur showing femoral trochlea in all groups
A- Medial trochlear ridge
B- Lateral trochlear ridge

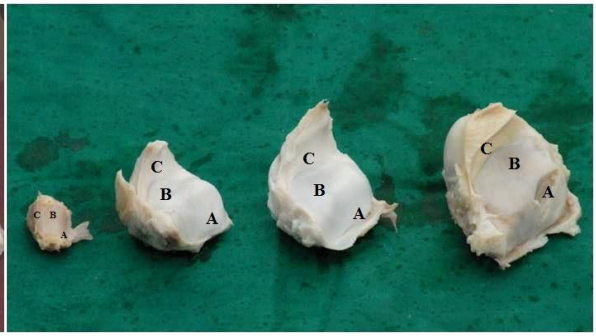


Fig. 2:

Photograph of ventral surface of patella in all four group showing anatomical details A- Medial surface B-Lateral surface C-Parapatellar cartilage

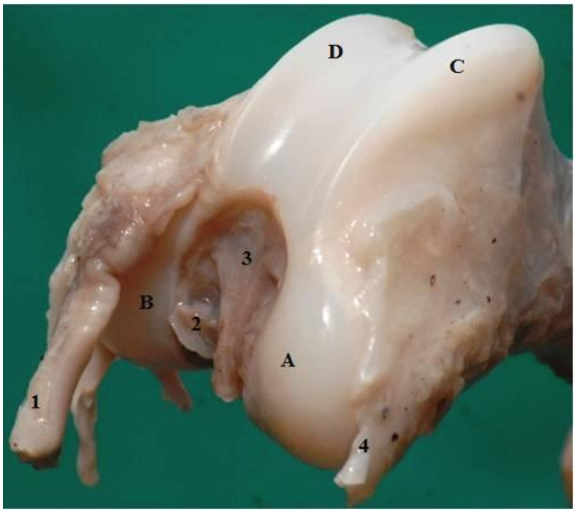


Fig. 3:

Photograph of distal extremity of femur of group I specimen aged 168 days (CVRL 41.8 cm) showing smooth and fleshy appearance of condyles and ligaments .1-Common origin of long digital extensor and peroneus tertius
2-ACL 3-PCL 4-Medial collateral ligament

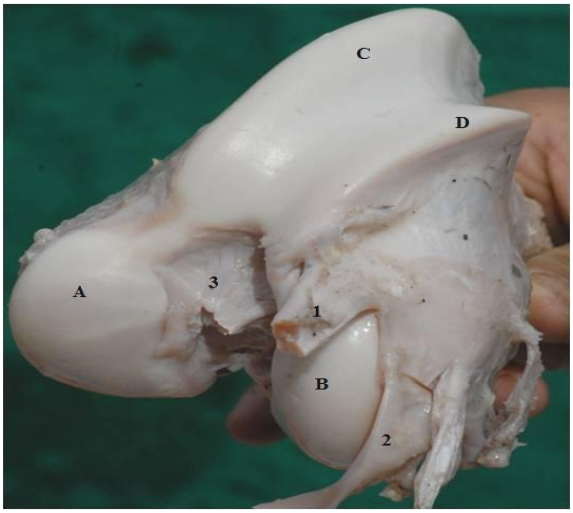


Fig. 4:

Photograph of anterior aspect of distal extremity of femur of group II showing condyles merging with respective trochlear ridges
A-Medial femoral condyle B-Lateral femoral condyleC-Medial trochlear ridgeD-Lateral trochlear ridge1-Common origin of long digital extensor and peroneus tertius 2-Popliteal tendon
3-PCL

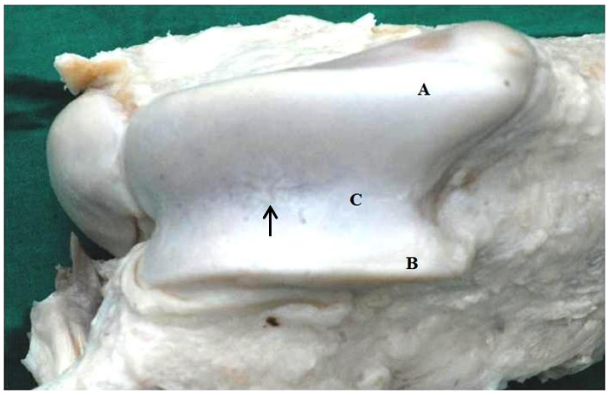


Fig. 5:

Anterior view photograph femoral trochlea of group IV showing yellowish discolouration and signs of wear and tear

A-Medial trochlear ridge
B- Lateral femoral ridge
C- Trochlear groove

CONCLUSION

Trochlea flanked by two ridges were slightly oblique in their longitudinal axis amongst which medial one was conspicuously broader and wider than the lateral one and was placed at a higher level. In fresh state the trochlea was smooth, shiny white with slight reddish tinge in prenatal specimens, shiny white in groups II and III and in case of aged specimens of group IV the trochlear surface and its edges showed signs of wear and tear. Length of the ridges grew significantly from prenatal to post natal stages (Table, 1 and Plate, 1). Thickness of the medial ridge was 22.94 ± 2.00 mm at proximal level which was very thick and stout when compared to that of lateral ridge (11.83 ± 0.30 mm) in adult animals but not in prenatal stages. The patella, which was observed as a triangular prism shaped structure in all four groups with thick piece of cartilage called as 'parapatellar' cartilage was attached to its entire medial border. The articular surface and length of patella increased significantly ($P \leq 0.01$) from group I to group IV specimens.

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