Area intercondylaris tibiae:
Osseous surface structure and its relation to soft tissue structures and applications to radiography

KLAUS JACOBSEN

Department of Orthopaedic Surgery T-3, The Gentofte Hospital, Copenhagen, Denmark

INTRODUCTION

A more detailed anatomical description of the fine osseous surface features in the knee joint has become necessary now that Kennedy & Fowler (1971) have published their special radiological method for estimating medial instability and the 'drawer' sign in the joint by measuring the shift between skeletal parts during the application of known forces. Exact identification of skeletal parts from film to film presupposes exact anatomical knowledge. However, such knowledge seems to be lacking for the area between the tibial condyles.

The anatomical textbooks of Hamilton (1956), Hollinshead (1964), Lang & Wachsmuth (1972), Gray (1962), and Cunningham (1972) give good accounts of this region, but not in sufficient detail to permit certain recognition on radiographs. In particular, the topographic relations of the soft tissues close to their bony attachments and in relation to bone surface features are not clearly described: the early work of Robert (1855) has been overlooked.

Parsons (1906) gave an excellent account of the way the soft tissue attachments left their marks on the bones. Negru (1943) described the *area intercondylaris anterior* as having a lateral, deeply excavated half and a medial taller, domed half. At the junction of these two parts he described a ridge, for which he suggested the term '*crista areae intercondylaris anterior*'.

A systematic description of the area may perhaps explain the occasional presence of bony knobs such as the '*tuberculum intercondylaris tertium et quartum*'.

In this paper an account is given of the osseous surface and its related soft tissue structures, viz. the corpus adiposum infrapatellare, ligamenta cruciata, cornua anteriores et posteriores, menisci medialis et lateralis and the connective tissue and synovial membranes which cover them.

DEFINITIONS, MATERIALS AND METHOD

In the present paper the area intercondylaris tibiae is defined as the area between the hyaline cartilage-covered medial and lateral tibial condyles together with the tuberculum mediale et laterale which are partly covered with hyaline cartilage.

The directive term 'central' will be used for the orientation of surfaces or parts facing the centre of the area.
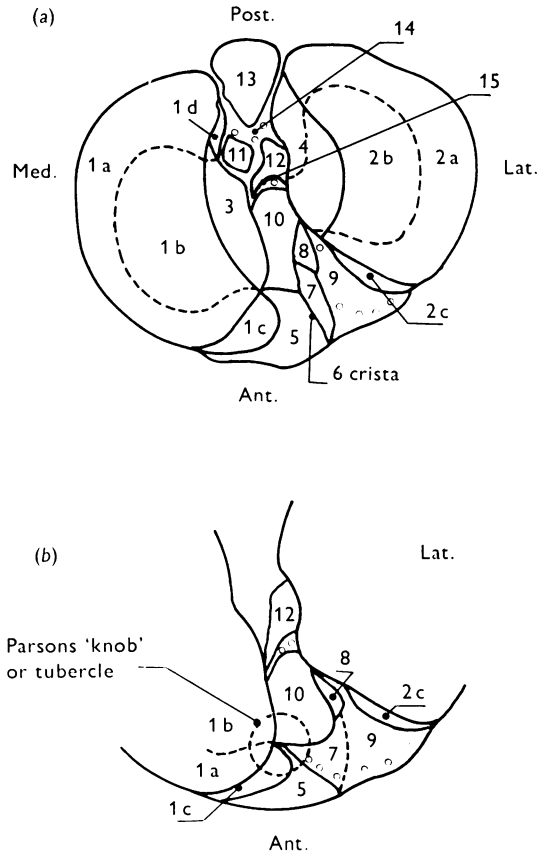
Fig. 1 (a) and (b). Upper extremity of the left tibia seen from above. (a) shows the most common arrangement of the facets in the area intercondylaris anterior, with formation of the crista (6). (b) shows another possibility, with the formation of 'Parsons' knob'. Intermediate forms are common. For full explanation see text. Location of foramina nutricia indicated by o.

The fastenings of the ligamenta cruciata to the tibia will be termed 'insertions', whereas the term 'origins' will be reserved for the femoral fastenings. All the fastenings of the menisci will be termed insertions, while those of the corpus adiposum infrapatellare, the loose connective tissue, and the synovial membrane will be termed attachments.

The material comprised 13 'fresh' formalin-fixed, dissected human knees devoid of lesions of the collateral ligaments, cruciate ligaments, articular cartilage, or menisci though minor fissures in the meniscus and slight signs of wear on the articular cartilage surfaces were permitted. In addition 75 macerated dry specimens of human knee joints were studied.

The various insertion facets were measured on the 13 fresh preparations. They were outlined on transparent foil placed over the specimens during the dissection and their areas measured using a pencil-follower (planimeter) and a general purpose computer (IBM 1800).

DESCRIPTION AND RESULTS

Area intercondylaris tibiae

The area as a whole comprises the area intercondylaris anterior, the area inter-condylaris posterior and the eminentia intercondylaris in between. No previous author has defined the boundaries between the anterior and posterior areas and the eminence.

Fig. 1(*a*), (*b*) illustrates the left *extremitas proximalis tibiae* viewed from above. The cartilage-covered medial tibial condyle is marked 1a, b, c, d. 1a indicates that part of the cartilage which normally 'articulates' with the medial meniscus. This may be seen on fresh preparations as an 'imprint'. 1b signifies the part articulating directly with the cartilage on the medial femoral condyle. 1c does not belong to the actual articular socket: it is a plane facet extending obliquely down from the arti-cular surface towards the area intercondylaris anterior. It is covered with a very thin layer of cartilage – so thin that in a fresh specimen the bone shows through it – and it articulates with the under aspect of the anterior horn of the medial meniscus. It is not weight-bearing. 1d is a corresponding area, sloping down towards the area intercondylaris posterior tibiae: it is against this facet that the under aspect of the posterior horn of the medial meniscus slides.

The cartilage-covered part of the condylus lateralis tibiae in Fig. 1(*a*) is labelled 2a, b, c; 2a signifies the 'imprint' of the meniscus lateralis, 2b indicates the area of contact with the cartilage on the lateral femoral condyle. Like 1c, area 2c is covered with thin cartilage: it is in contact with the anterior horn of the lateral meniscus. There is no corresponding area to 1d for the posterior horn of the lateral meniscus because this passes across the posterior arcuate part of the tuberculum laterale which is everywhere covered with thick cartilage.

The number 3 indicates the tuberculum mediale. Its demarcation line centrally follows the cartilage junction, which as a rule reaches at least as far as its peak (12 out of 13 cases). The 'slope' of the tuberculum mediale inclining towards the centre of the bone is not included within this contour. The demarcation medially – i.e. towards the medial condyle articular surface – is where the tuberculum mediale begins to rise above the level of the condylar joint surface. Area 3, by definition, is covered with articular cartilage.

Area 4 signifies the articular cartilage-covered part of the tuberculum laterale, which is invariably lined with articular cartilage up to its summit. The tuberculum laterale then drops abruptly down towards the central part of the bone, so that, viewed from above, the cartilaginous border and the central boundary line of the tuberculum are coincident.

The two summits, tuberculum laterale and tuberculum mediale, are connected by a concave ridge which passes from the central side of the tuberculum mediale obliquely backwards and laterally to meet the tuberculum laterale. In Fig. 1(*a*) this ridge comprises large areas (11 and 12) and smaller areas (14 and 15). Anteriorly the ridge first slopes rather steeply down (cf. the small area 15) but thereafter the inclina-tion continues evenly into area 10. Posteriorly, it drops rather abruptly down to-wards area 13. Even on a macerated bone the junction between areas 13 and 14 is always distinct.

Table 1. *Measurements of some important parameters of the area
intercondylaris, based on* 13 *dissected specimens*

	Mean (mm)	Range
Height of the tuberculum mediale	10	8–12
Height of the tuberculum laterale	7	3–10
Width of the area intercondylaris		
Anteriorly	35	26–43
Posteriorly	16	12–22
Between the tuberculum laterale and mediale	11	7–14
Area 10: length	17	13–20
width anteriorly	13	11–18
width posteriorly	8	4–11
Area 13: length	15	12–18
width posteriorly	16	12–21
The angle between the plane of the area intercondylaris anterior and posterior, in degrees	128	115–140

It is proposed that the ridge between the tubercula be termed the *crista intertubercularis* (c.i.t.); that the *eminentia intercondylaris* be defined as the tubercula plus the crista intertubercularis; and that the region anterior to these structures (1c, 2c, 5, 7, 8, 9, 10) be called the *area intercondylaris anterior*, and the area behind them (area 13) the *area intercondylaris posterior*.

The small area 1d cannot be incorporated in this classification: it is to be taken as belonging to the medial tibial condyle.

Table 1 lists the measurements of some important details of the area intercondylaris. The tubercula were measured with cartilage on the preparations. In all cases the tuberculum mediale stood higher than the tuberculum laterale. The rather wide range of variation is only in part a reflection of differences in overall bone size.

Area intercondylaris anterior, then, comprises 1c, 2c, 5, 7, 8, 9 and 10. The first two of these have already been described. 6 indicates the longitudinal ridge, crista areae intercondylaris anterior (c.a.i.a.) which divides the area into a lateral, deeper part and a medial plateau. The ridge runs approximately in an anteroposterior direction, but bends in a faint curve posteriorly between areas 8 and 10 towards the lateral side. The ridge is most pronounced anteriorly where it forms the lateral boundary of area 5. Here it may be raised to the level of the tubercula (laterale and mediale). In AP radiographs therefore, it will appear as a projection between the two tubercles. In one of the 13 fresh specimens the ridge was very prominent indeed and the whole of area 5 was incorporated in it (Fig. 2). In another the crest was extremely well marked, in 3 it was faint, but easily seen to trace, while in 2 cases it was too faint to trace. In 75 % of the macerated bones the c.a.i.a. was distinct or easy to trace, in 25 % difficult to trace or lacking. None showed such marked prominence of the c.a.i.a. and area 5 as the fresh specimens (cf. Fig. 2).

A profile other than the c.a.i.a. may dominate the area intercondylaris anterior, viz. a knob, described by Parsons (1906) in relation to the lateral cartilaginous
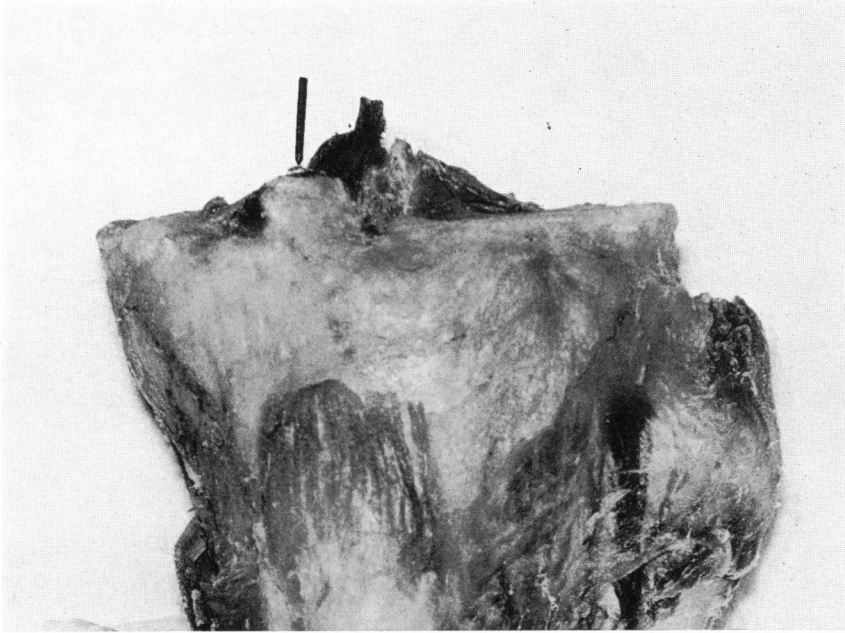
Fig. 2. Upper extremity of the left tibia. The specimen shows the crista areae intercondylaris anterioris elevated as a 'tubercle' (arrow). The dark structure on top of the central part of the intercondylar eminence is the distal part of the anterior cruciate ligament, showing that the 'tubercle' in this case is anterior to the insertion of the ligament.

junction of the medial tibial condyle anteriorly (Fig. 1 *b*). It has the shape of a broad-based cone and the anterior part of the ligamentum cruciatum anterius arises from it. This structure will be referred to as 'Parsons' knob'. When strongly developed the adjacent areas may drop steeply from its peak down towards the valley (area 9, Fig. 1 *b*), and the c.a.i.a. may be entirely absent or reduced to an insignificant line. However, both knot and crest are often present in the same specimen and in that event the c.a.i.a. becomes more curved than that shown in Fig. 1 (*a*). In 4 cases out of 13 there was a distinct Parsons' knob co-existing with an unmistakable c.a.i.a. A distinct Parsons' knob was demonstrated on 45 % of the macerated bones. In two cases observed at operation, the knob was so marked that the term 'Parsons' tubercle' seemed more appropriate. Among the macerated bones such a structure was found in 8 cases (11 %).

The posterior part of the c.a.i.a. is usually lower than its anterior part. It separates area 10 from areas 7 and 8 which are of a lower level. Between the anterior and posterior parts there may be some flattening of the crest, a wedge-shaped part of area 7 forcing its way in between areas 5 and 10 (Fig. 1 *b*). In one specimen this wedge-shaped part on the middle of the crest exhibited a triangular insertion facet for the ligamentum transversum genus, which in this case was formed by fibres from the anterior horns of the two menisci. Some fibres of the ligament ran between the two menisci, others decussated and took an arcuate course down to the insertion on the facet.
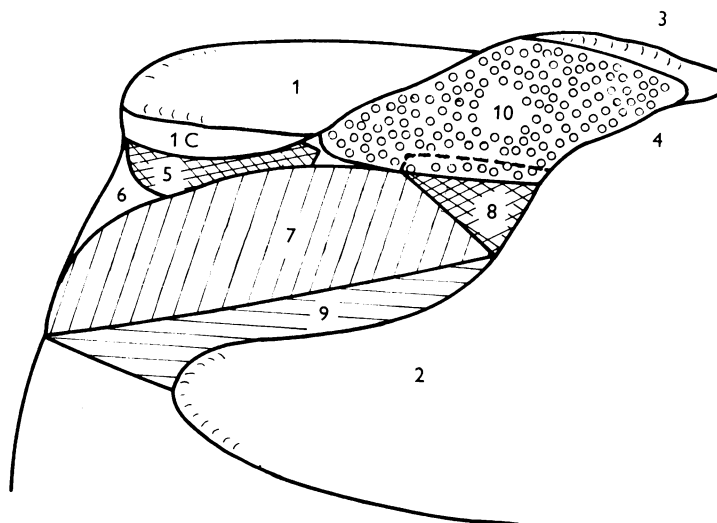
Fig. 3. Area intercondylaris anterior. Left tibia. Showing the two different levels at which the
lateral part, area 9, and the medial part, areas 5 and 10, are situated.

On the anterior part of the c.a.i.a. the most lateral fibres from the anterior horn
of the meniscus medialis are inserted. On the posterior part the most lateral fibres
of the ligamentum cruciatum anterius, together with fibres from the anterior horn of
the meniscus lateralis are inserted.

Area 5 is the anterior part of the medial plateau of the area intercondylaris
anterior. It appears as a slight groove or impression, about 1 cm in diameter and
serves as the site of insertion for the cornu anterius menisci medialis. As already
mentioned, it may be elevated, forming a ridge continuous with that of the
anterior part of the c.a.i.a. In several macerated bones area 5 was represented by
a very deep impression and its junction with area 10 stood out as a ridge which,
however, did not project above the level of the articular surfaces. In two of the fresh
specimens area 1c was larger than area 5.

Area 7 is the term for the oblique wall dropping more or less abruptly from the
anterior part of the c.a.i.a. towards the deep lateral valley, area 9 (see also the profile
depicted in Fig. 3). In one case where the anterior part of the crest was highly de-
veloped it was almost vertical. Together with area 9 it forms a bowl in which the
corpus adiposum infrapatellare settles and has its attachment. Area 7 may send an
extension up between areas 5 and 10, tending to be particularly well developed in
specimens where Parsons' knob is conspicuous (Fig. 1b). This extension gives attach-
ment to synovial membrane and frequently shows foramina nutricia. The boundary
between it and area 9 is poorly defined.

Area 8 is that part of the oblique wall of c.a.i.a. which is occupied by the insertion
of the cornu anterius menisci lateralis. This insertion usually continues over area 10
(note the dotted line in Fig. 3). It should be noted that the cornu anterius menisci
lateralis is not inserted on the anterior aspect of the tuberculum laterale. However,
the most posterior fibres may insert on the central, vertical wall of the tuberculum

laterale. On macerated bones it may be difficult to determine the boundary between areas 8 and 10.

Area 9 is the deep valley laterally which extends posteriorly to the site where the medial wall of the tuberculum laterale meets the c.a.i.a. This area forms the bottom of the bowl in which the corpus adiposum infrapatellare rests. In this area there are foramina nutricia in varying numbers and localization, especially anteriorly. The most constant of the foramina is a large one at the posterior tip of the area, between area 8 and the anterior edge of the tuberculum laterale.

Area 10 is the insertion facet on the tibia for the ligamentum cruciatum anterius. It extends as a prolongation of the medial plateau backwards between the tuberculum laterale and mediale, reaching posteriorly as far as the anterior slope of the eminence (area 15). Anteriorly it is sharply demarcated from area 5. Medially the area (and thus also the ligament insertion) follows the cartilaginous border of the condylus medialis tibiae right to the peak of the tuberculum mediale, the ligament fibres inserting on the cartilaginous border. Furthermore, the insertion covers the steep, central side of the tuberculum mediale. The ligament has no connexion with the cartilaginous border on the tuberculum laterale.

Commonly there is anteriorly a Parsons' knob or even a crest towards area 5. In a few cases (among the macerated bones) the knob was found at the antero-lateral corner of area 10 rather than at the cartilaginous border.

In a small segment, where area 8 adjoins area 10, there is, as already mentioned, almost invariably some overlapping of the insertions of the cornu anterius menisci lateralis and the ligamentum cruciatum anterius (Fig. 3). On 2 fresh specimens the conjoined insertion was visible on the bone as a special facet.

Eminentia intercondylaris. The relative dimensions of the tuberculum mediale and the tuberculum laterale have already been given (Table 1). The cartilage-covered medial aspect of the tuberculum mediale and the lateral aspect of the tuberculum laterale articulate with parts of the central aspects of the cartilage-covered femoral condyles. The cartilage-covered anterior edge and the posterior part of the tuberculum laterale articulate with the anterior and posterior horns of the meniscus lateralis respectively. The tuberculum mediale does not articulate with the meniscus medialis nor (normally) with the ligamentum cruciatum posterius, which proceeds upwards proximal to the posterior horn of the meniscus medialis posteriorly and the posterior horn of the meniscus lateralis anteriorly.

Area 11 is an almost vertically oriented facet on the posterior, sloping side of the tuberculum mediale, giving insertion to the cornu posterius menisci medialis. This insertion is nowhere in direct continuity with the articular cartilage on the medial condyle. This facet was present on all the macerated specimens. In one case it exhibited an osseous knob.

Area 12 is the insertion facet for the cornu posterius menisci lateralis. It is more horizontal than area 11, in certain cases completely horizontal, and is on a higher level, the medial process of the facet being on top of the c.i.t. above the level of area 11. The lateral part of area 12 is normally situated on a slightly sloping segment of the posterior aspect of the c.i.t. and tuberculum laterale. With Parsons, it may be said that the cornu posterius menisci lateralis on the tibia has a lateral as well as a medial insertion. The latter, long and narrow, aims at the peak of the tuberculum mediale
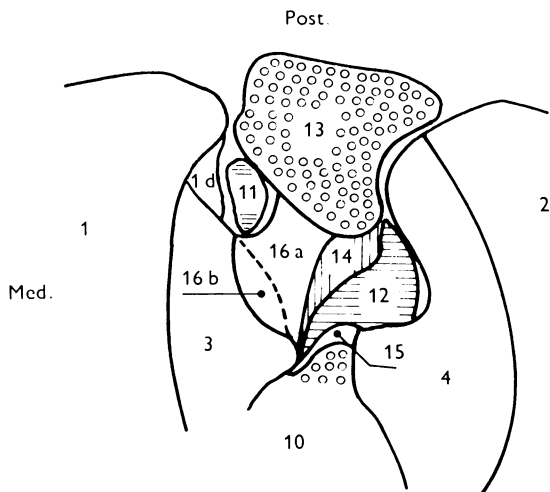
Fig. 4. The eminentia intercondylaris and the area intercondylaris posterior seen from above. Left tibia. Variant.

without, however, inserting into its cartilage. On all specimens the fibres from the two insertions insert on one continuous facet. Some fibres of the lateral insertion may arise from the cartilaginous border where area 12 adjoins the anterior peak of the tuberculum laterale.

Area 14 is the inferior part of the posterior wall of the c.i.t. It serves as attachment for the loose connective tissue between the structures. Incidentally, it may be mentioned that the various facets, as well as their fibrous structures, are always separated by a layer of this loose connective tissue – except at the above-mentioned site where area 10 adjoins area 8. Area 14, therefore, has an irregular course. On macerated specimens the skeletal surface has a characteristic appearance, being slightly depressed in relation to the insertion facets and showing foramina nutricia in varying numbers, size, and site. It should be noted that foramina are never present in the insertion facets.

Area 15 is behind area 10, along the anterior wall of c.i.t. It is a narrow area which, like area 14, serves as attachment for the loose connective tissue which ensheathes the cruciate ligaments and, like them, is extrasynovial. This area constantly houses one or more small arterial and venous branches from the vasa genus media which run downwards along the posterior aspect of the ligamentum cruciatum anterius, penetrating the bone through a foramen nutricium. At this site 96% of the macerated bones showed one or more foramina nutricia (1–5) (Fig. 1).

Area 16 was present in only one specimen. In this case the ligamentum cruciatum posterius slid directly onto the posterior aspect of the tuberculum mediale and its peak (Fig. 4). The area was covered with very thin cartilage, like areas 1c, 1d and 2c, replacing the usual fibrous tissue on the posterior aspect (16a) and thick hyaline cartilage on the peak (16b) of the tuberculum mediale. A similar case presumably is the basis for Cunningham's (1972) Fig. 235, where a 'synovial covered surface' is depicted approximately at this site.

Table 2. *Size of areas* 1c *to* 16 (*in square millimetres and as percent of total area*) *measured in* 13 *fresh specimens*

('Total area' does not include areas 3 and 4.)

Area	Size (mm²)		% of total area	
	Mean	Range	Mean	Range
1c	76	36–115	7	3–11
2c	64	33–103	6	3–9
1d	35	13–63	3	1–5
5	116	68–174	11	8–18
7	68	39–98	6	4–9
8	42	24–57	4	2–6
9	144	57–269	13	6–21
10	182	132–278	17	13–24
11	34	23–55	3	2–4
12	80	40–115	7	3–10
13	181	129–226	17	13–20
14	56	32–94	5	3–9
16 (only one case)	68		6	

Area intercondylaris posterior (*area* 13)

Area 13 is situated posterior to and at the foot of the eminence massif, deeply depressed between the two condylar joint surfaces. It gives insertion to the ligamentum cruciatum posterius. It does not reach the cartilage edges on either side, as the ligament fibres do not insert on to the cartilage. The fibres in fact insert well below the edge of the lateral condyle, whose upper contour is formed by the tall posterior arch of the tuberculum laterale. On all the macerated bones area 13 presented itself as a discrete, well-defined, flat facet, as pointed out by Poirier in 1892. Protuberances were never found on this facet.

The relative and absolute size of all these areas, as measured on the fresh specimens, is shown in Table 2. On the macerated bones the areas of insertion were found in all cases, but one or more of the small cartilage-lined areas 1c, 1d, and 2c could not be demarcated from areas 5 and 9 in more than half the cases.

The synovial attachment can be traced from the posterior aspect medially, along the lateral cartilaginous junction on areas 1a, 1d, 3, 1c, then along the junction between areas 5 and 10 (Fig. 1a) and the lateral junction of areas 5–10 as far as area 8. Thereafter, it follows the junction of area 8 with areas 7 and 9 until it reaches the tuberculum laterale. After this it follows the medial cartilaginous junction of areas 4 and 2c forward and that of areas 4 and 2a backward. On the variant shown in Fig. 4 it followed the junctions of areas 16 and 11, 12 and 14.

Relation to lateral radiograph. If the extremitas proximalis tibiae is viewed from the lateral aspect the contours of the tubercula are as shown in Fig. 5 (traced from a lateral radiograph). These contours are of great importance in identifying the two tibial condyles in lateral radiographs of the knee joint. The tuberculum mediale rises evenly and starts more anteriorly than the tuberculum laterale, which rises steeply. Posteriorly, the tuberculum mediale drops first, and very abruptly, towards area 13. Behind this the posterior aspect of c.i.t. drops less steeply towards area 13,
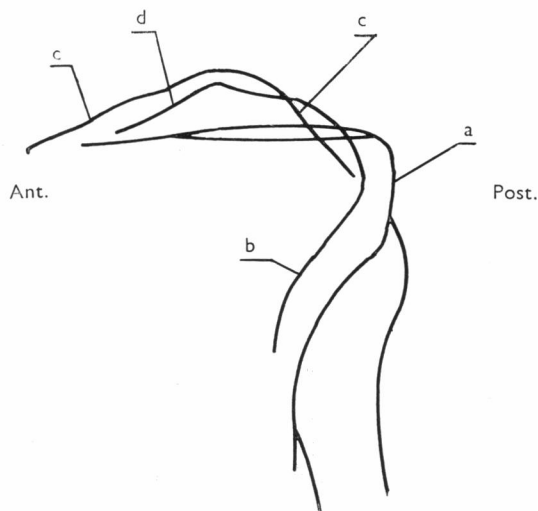
Fig. 5. Profile of the tubercles and the area intercondylaris posterior in lateral view. (a) Posterior profile of the condylus medialis of the tibia. (b) Posterior profile of the condylus lateralis of the tibia. (c) Tuberculum mediale. (d) Tuberculum laterale.

whereas the tuberculum laterale, in a gentle curve (Fig. 5), meets the posterior medial corner of the socket of the condylus lateralis and continues in the posterior contour. On lateral radiographs this acts as a definite landmark for the identification of the posterior contour of the condylus lateralis.

The contour of the tuberculum laterale has a slightly arcuate notch behind the anterior, highest peak (on a level with area 12), at the site of the cornu posterius menisci lateralis. This notch was absent in only 3 % of the macerated specimens. In 2 cases there was an osseous knob on the posterior, curved part of the tuberculum laterale. In one case an osseous knob was found at this site during an operation.

DISCUSSION

On the basis of the anatomical description of the area intercondylaris, with the new details which have been detected, it is now possible to correct the highly varying textbook diagrams illustrating the soft tissue insertions in this region. In Hollinshead's textbook the illustration is quite schematic; in the others more or less so. Fick (1904), as well as Poirier (1892), left a large empty space centrally between the insertions of the anterior cruciate ligament and the anterior and posterior cornua of the lateral meniscus. This empty space is a fiction concealing the close relationship between the insertion of the ligamentum cruciatum anterius and the cornu anterius menisci lateralis, where frequently some of the fibres from the two structures are intertwined as noted already by Robert (1855) and by Parsons (1906). In *Gray's Anatomy* the insertion of the ligamentum cruciatum anterius is indicated without any contact with the cartilaginous border of the medial tibial condyle – and no textbook makes any mention at all of a relationship between the insertions and the cartilaginous

junctions. Frazer in his *Anatomy of the Human Skeleton* (1920) gives, for the posterior cornu of the lateral meniscus, only a small insertion facet behind the tuberculum laterale, and this is followed in the most recent edition (1965). My findings, however, indicate the correctness of Parsons' description: 'Along the summit of this ridge (crista intertubercularis), as far as the internal tubercle, the posterior fibres of the posterior cornu of the external semilunar cartilage are attached.'

I also agree with Parsons in his statement that throughout the region the fibrous insertions leave facets and that every little elevation and depression has its meaning. On macerated bones the insertion facets are clearly separated from the areas which serve for the attachment of the loose connective tissue between the fibrous structures. These areas are slightly excavated, look more porous, and exhibit foramina nutricia.

The situation of the foramina nutricia varies. They are most constantly present in area 15, behind the insertion of the ligamentum cruciatum anterius, where they were noted by Humphry (1858), but not by Pfab (1927) or Crock (1962). One or more foramina right in the central part of area 9 was a fairly constant finding.

It must be stressed, however, that there are great variations in the shape of the region, as is apparent from Table 2 which gives the sizes of the areas. Percentages give the clearest indication of the relative sizes of the different facets. The largest facets are those where the ligamentum cruciatum anterius and posterius are attached – and they are about the same size (both averaging 17%). It should be pointed out that the ligamentum cruciatum anterius has a larger, and more centrally situated, insertion than is generally assumed. The medial meniscus has its largest facet anteriorly, whereas the lateral one has its largest facet posteriorly.

It would seem appropriate to use Negru's terms 'crista areae intercondylaris anterior' and 'impressio digitalis tibiae', the latter for area 5.

Mouchet & Noureddine (1925), from measurements made on radiographs, found the tuberculum mediale to be taller than the tuberculum laterale in 73% of the cases, the same height in 13% and shorter in 10%: in 4% they found an undivided, rounded eminentia intercondylaris. Their findings have been confirmed by Schlüter & Becker (1955) and Jonasch (1958). On the basis of measurements on specimens Robert reported that the tuberculum mediale is 10 mm high, the tuberculum laterale 8 mm, which is in accordance with the present material (Table 1).

The *tuberculum intercondylare tertium* is a radiological–anatomical concept defined by Politzer & Pick (1937) as a skeletal prominence presenting itself on the lateral radiograph of the knee joint about 2 cm anterior to the eminentia intercondylaris. In the anteroposterior view the osseous knob is visible between the tuberculum mediale and laterale. According to these authors the underlying anatomical detail is situated in the anteromedial corner of the insertion of the ligamentum cruciatum anterius – in other words it is identical in situation with Parsons' knob (which when large enough may be called 'Parsons' tubercle'). Such a tubercle was found in 8 cases among the macerated bones in my collection. It must be emphasized, however, that there are all transitions between well-developed 'knobs' and 'tubercles'. In their original paper, Politzer & Pick in fact stated that a knob may sometimes be seen radiologically at this site.

In 4 cases there was a well-developed Parsons' knob among the fresh specimens, but in no case was there anything which could be classed as a 'tubercle'. However,

in 2 patients I have had occasion to examine knee joints in the course of arthrotomy, after radiography had disclosed a tuberculum tertium. In both cases there was a well-developed Parsons' tubercle. Parsons' 'knob' and 'tubercle' and the radiologists' 'tuberculum intercondylare tertium' evidently refer to one and the same osseous feature.

Tuberculum intercondylare quartum. Wichtl, in 1941, described a bone shadow on lateral radiographs, situated posteriorly over the area intercondylaris posterior at the edge of the lateral tibial condyle. Drawing an analogy from Politzer & Pick's findings, Wichtl deduced that it was situated at the insertion of the ligamentum cruciatum posterius. He called it the tuberculum intercondylare quartum. Osseous knobs were not in fact demonstrated in the posterior part of the area intercondylaris in any of my fresh specimens, but surgical examination of one patient with a radiologically demonstrable large osseous knob at this site revealed that the knob was situated outside the ligamentum cruciatum posterius on the tuberculum laterale. Among the macerated bones two had osseous knobs on the posterior, curved part of the tuberculum laterale and one had a knob on area 11. Knob formation was never found at the site of area 13. It must be pointed out also that the ligament does not insert on the edge of the lateral tibial condyle as assumed by Wichtl. I am, therefore, very sceptical of his assumption that a 'tuberculum quartum' represents knob formation in the insertion facet of the ligamentum cruciatum posterius and believe it to represent knob formation on the posterior part of the tuberculum laterale.

Detailed anatomical description of the area intercondylaris is important for the accurate identification of skeletal structures and soft tissue insertions in radiographs. Negru has analysed the contours of structures in the area intercondylaris anterior tibiae in lateral radiographs but makes no mention of the facts that (1) the shape of the posterior contours of the tuberculum mediale and laterale can be used for the identification of the posterior contours of the two tibial condyles, (2) the posterior contour of the condylus lateralis tibiae may be identified by tracing the posterior, curved part of the tuberculum laterale. This latter contour is most useful as a landmark in measuring a 'drawer sign' in the knee joint by the radiological method of Kennedy & Fowler (1971).

SUMMARY

The area intercondylaris tibiae is defined as the area between the tibial condyles, including the tuberculum mediale and laterale. A description of the area is given, based on the study of 13 fresh specimens of human knees and 75 macerated specimens. It was demonstrated that for each fibrous tissue insertion and soft tissue attachment there is a corresponding osseous surface structure which could be identified also on the macerated specimens. This confirms the principle advanced by Parsons in 1906. A number of terms are suggested for conspicuous features: viz. crista intertubercularis, Parsons' 'knob' and 'tubercle', crista areae intercondylaris anterioris, impressio digitalis tibiae. The entire intercondylar area is sub-divided into well-defined unit areas. The sizes of these unit areas were measured by computerized planimetry. Textbook illustrations of insertions in the area are inaccurate and should be corrected.

It is demonstrated that the radiologists' tuberculum intercondylare tertium is the

shadow of an anatomical structure, 'Parsons' tubercle'. Other osseous knobs in the region are mentioned. In particular, the crista areae intercondylaris anterioris may be very highly developed. On the other hand the radiologists' tuberculum quartum tibiae is not at the insertion of the ligamentum cruciatum posterius, as assumed by Wichtl, but is on the posterior part of the tuberculum laterale.

Among minor details, not previously mentioned in the literature, there are certain small areas (1c, 1d and 2c) which are thinly coated with cartilage. These areas articulate only with the under aspect of the meniscal cornua. Areas 14 and 15, for the insertion of loose connective tissue, and area 16, a variant feature of the tuberculum mediale, are also described. Lastly, a description is given of normally occurring, but not previously mentioned, vessels which run down behind the ligamentum cruciatum anterius into the tibial condyle through foramina nutricia.

Accurate knowledge of the posterior contours of the tuberculum mediale and laterale raises the possibility of distinguishing between the two tubercles and of identifying the posterior contours of the two tibial condyles on lateral radiographs of the knee joint.

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