

# Morphology of the proximal synovial cavity in the adult knee joint

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## *Erişkin diz ekleminde proksimal sinovyal boşluğun morfolojisi*

*Suprapatellar poş ve suprapatellar plika diz ekleminde proksimal boşlukta değişebilen yapılardır. 210 erişkin diz ekleminde morfolojik muayene ve 2056 artrografide yapılan radyolojik muayene suprapatellar bursa ve diz eklem boşluğu arasında dört çeşit suprapatellar septum ortaya çıkarmıştır. Tam, perforé, residüel ve kaybolmuş (tip 1-4). Vakaların çoğunda lateral suprapatellar boşluk saptanmış ve benzeri bir yapı medialde gözlenmemiştir. Suprapatellar poşun masif ekstansiyon veya suprapatellar bursanın yırtılarak psödokist oluşurması, ki ikisi de artmış eklem içi basınca bağlıdır, gösterebilmiştir. Suprapatellar ağrı yakınması olduğunda bunlar hesaba katılmalıdır.*

**Anahtar Kelimeler:** *Suprapatellar septum, suprapatellar plika, suprapatellar bursa, lateral suprapatellar cep, suprapatellar kist, suprapatellar poş*

*The suprapatellar pouch and the subrapatellar plica are variable structures of the proximal cavity of the knee joint. Morphologic examinations of 210 adult knee joints and radiologic studies of 2056 arthrograms revealed four variants of the subrapatellar septum between the subrapatellar bursa and the knee joint cavity: A complete, a perforated, a residual and an extinct septum (type I-IV). In several cases, a lateral subrapatellar recess was found. A similar structure on the medial side was not seen. Massive extension of the suprapatellar pouch or rupture of the suprapatellar bursa with pseudocyst formation both due to increased intraarticular pressure could be represented. They should be taken into account if suprapatellar pain occurs.*

**Key words:** *Suprapatellar septum, suprapatellar plica, suprapatellar bursa, lateral suprapatellar recess, suprapatellar cysts, suprapatellar pouch*

Pneumoarthrography is a good method to examine the synovial spaces of the knee joint. By means of inflation, it is possible to demonstrate most of the details of the joint cavity. In some cases the application of contrast medium is necessary to give a better view. The existence of additional spaces without communication to the knee joint cavity can be proved by direct puncture and subsequent administration of contrast medium. But still a few problems remain undissolved. The synovial structure separating the suprapatellar pouch from the knee joint cavity cannot be demonstrated in every case. Sometimes additional spaces do exist near or proximal to the suprapatellar pouch. A direct macroscopic view is necessary to understand the indirect radiological findings.

## Material and methods

210 knee joints of 149 adult specimens (74 female and 75 male) and 13 knee joints of 8 fetus (15.-30. week of pregnancy) were studied anatomically. After a sagittal skin incision, the knee joint cavity was prepared in such a way, that the patellar ligament and the patella could be folded to a proximal direction. The suprapatellar septum was inspected and documented, before preparing the proximal spaces of the

knee joint cavity.

2056 arthrogrammes of knee joints, which were done to patients with little trauma (665 females, 1391 males), were studied in comparison with the macroscopical results. They were recorded in a standard programme with a magnifying image amplifier television chain. The x-rays were made in a lateral view in 30-40° flexion of the knee joint. Isolated rooms were punctured directly to applicate contrast medium.

## The suprapatellar septum

The "suprapatellar pouch" and the "suprapatellar plica" are variable structures of the proximal knee joint cavity. Concerning this different data do exist in the literature, none of them taking prenatal development into account (3, 8, 10, 12- 14, 16-19, 22, 23, 28, 32, 34, 39). A closer look at the ontogenesis of the knee joint is necessary to clearly define the terms. During the 8th or 9th embryonal week, the joint fissure becomes visible in the knee joint (6, 7, 9, 11, 25, 29- 31, 37, 38). The joint cavity results from mesenchymal connective tissue involuting between the cartilaginous surfaces of the skeletal parts (1, 21). At the end of the 4th fetal month the knee joint cavity is separated from the suprapatellar bursa by a complete

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septum. A perforation of the septum normally occurs at the end of the 5th fetal month, resulting in a communication of the two cavities (15, 27). Our own examinations with fetal knee joints confirm these observations. A complete septum was found in seven fetal knee joints of 15, 16, 17 and 22 wk of pregnancy. In six fetal knee joints of the 20, 22, 27 and 30 wk of pregnancy there was a communication between the knee joint and the suprapatellar bursa.

Taking this prenatal development into account, the morphological variants of the adult suprapatellar septum can be classified into four groups (Fig. 1), (41). A complete suprapatellar septum (type I, Fig. 2a) with an isolated suprapatellar bursa was found in 16% of the anatomical and in 11% of the radiological examinations (Table 1). In the radiograph, the suprapatellar bursa is not seen (Fig. 3a). It's existence can be proved by direct puncture and subsequent administration of contrast medium.

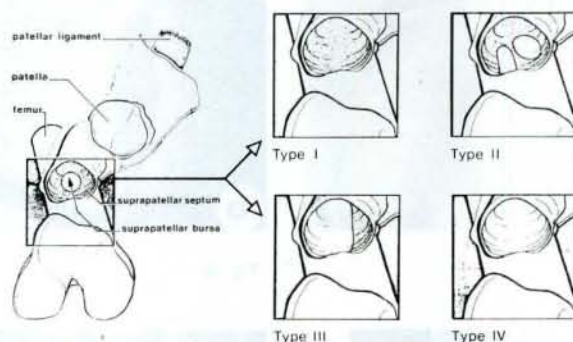


Fig. 1. Classification of the suprapatellar septum in adults into four types considering ontogenetic development. In type I (complete septum) the knee-joint cavity is completely separated from the suprapatellar bursa. Type II (perforated septum) is characterized by the presence of one or several openings, which differ in extent and localization. The residual fold found in type III (residual septum) varies in size and is almost invariably located medially. The suprapatellar septum is completely involuted in type IV (extinct septum)

With an incidence of 30% (anatomical cases), a perforated septum (type II, Fig. 2b), showing one or more openings of different extent and/or different localization, was much more common. Radiologically the opening is marked by lines which correspond to the portions of the septum (Fig. 3b). A residual septum (type III, Fig. 2c) is a remaining fold, almost always in a medial localisation and constituted the most frequent variant of the anatomical cases since it was found in 43%. This structure is mostly called "suprapatellar plica" in clinical terminology. Radiologically, this can be demonstrated if orientated towards

the film plate (Fig. 3c). Rotating the leg by 180° the septum is too far from the film plate and can no longer be demonstrated (Fig. 3c). In the radiological examinations, type II and III came to 87%. They were combined (Table 1) because it was not possible to distinguish between these two types retrospectively. A complete involution of the former septum (type IV, Fig. 2d) occurred in 11% of the anatomical and in 2% of the radiological cases. Joint cavity and suprapatellar recess are only one space. No septum structure can be identified (Fig. 3d). Jouanin and co-workers (18) classified the suprapatellar septum into three types. The authors did not provide any quantitative information about the two variants of type I. The system does not allow for the different possibilities of localization and number of perforation openings concerning type II. A complete involution of the suprapatellar septum was not mentioned at all.

The structural variety of the suprapatellar septum

is often described in arthroscopic literature by many types. Both Hempfling (12, 13) and Watanabe (40) distinguished between 9 types although they did not mention a complete involution of the suprapatellar septum. The proposed classification (41) also considers prenatal development and includes all variations with its four types.

### Lateral suprapatellar recess

A saccular space i. e. a suprapatellar lateral recess was found besides the suprapatellar bursa on the lateral side in 17% of the adult knee joints. None of the knee joints exhibited such a recess on the medial side in the anatomical and in the radiological examinations. Kenji (20) saw a suprapatellar lateral recess in more than 50% of his case. The difference between the two studies might be due to geographic reasons. Kenji examined Japanese people, the presented results were found in middle-europeans. Dandy (3) has shown differences between Japanese

Type	Morphologic term of the suprapatellar septum	Relative frequency (%)	
		Anatomically	Radiologically
I	Septum completum	16	11
II	Septum perforatum	30	87
III	Septum residuale	43	
IV	Septum extinctum	11	2

Table 1





Fig. 2a

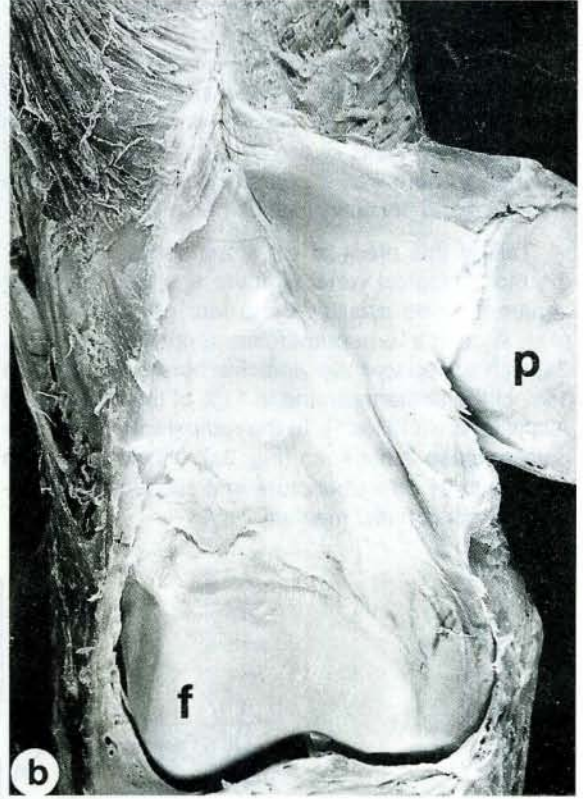


Fig. 2b

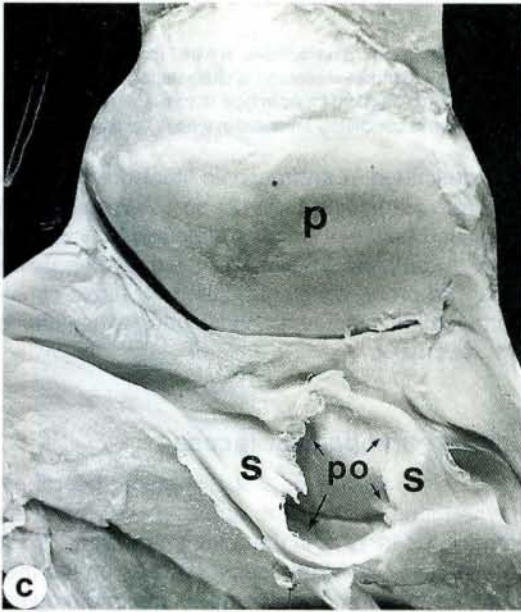


Fig. 2c

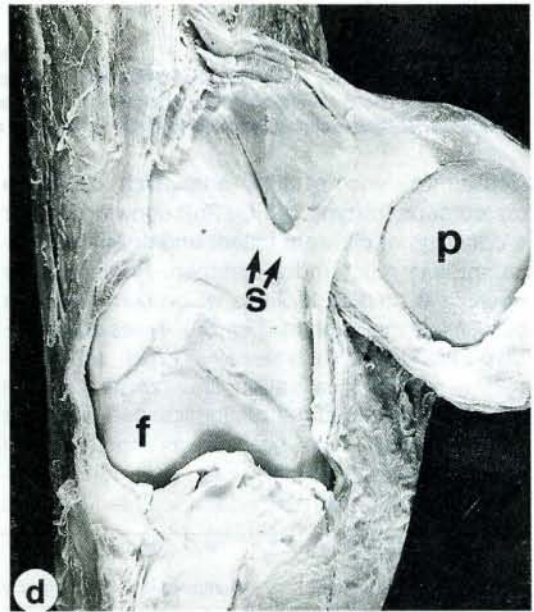


Fig. 2d

Fig. 2: a. A complete suprapatellar septum (s), separating the suprapatellar bursa from the knee-joint cavity (f=femur, p=patella).  
b. Knee-joint cavity and suprapatellar recess form a common space, there is no septum structure.  
c. A perforated septum with a central opening (po=porta).  
d. A residual septum (s) at the medial side of a right knee joint.

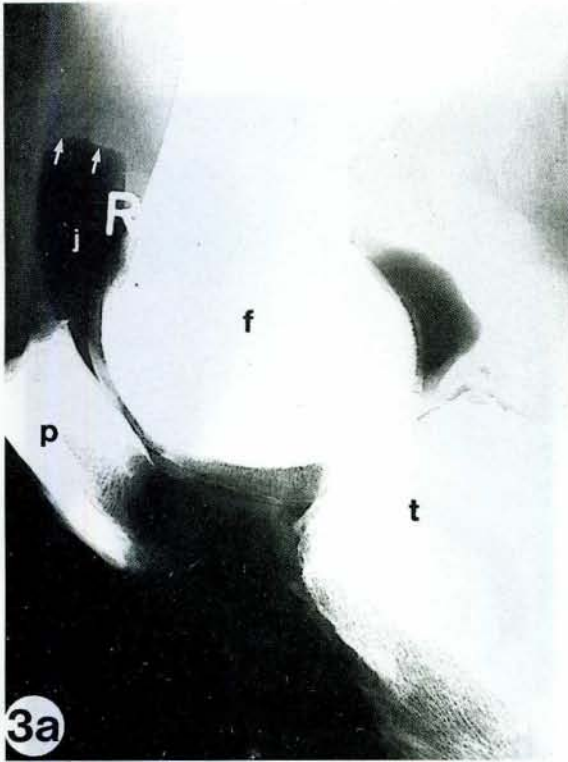


Fig. 3a

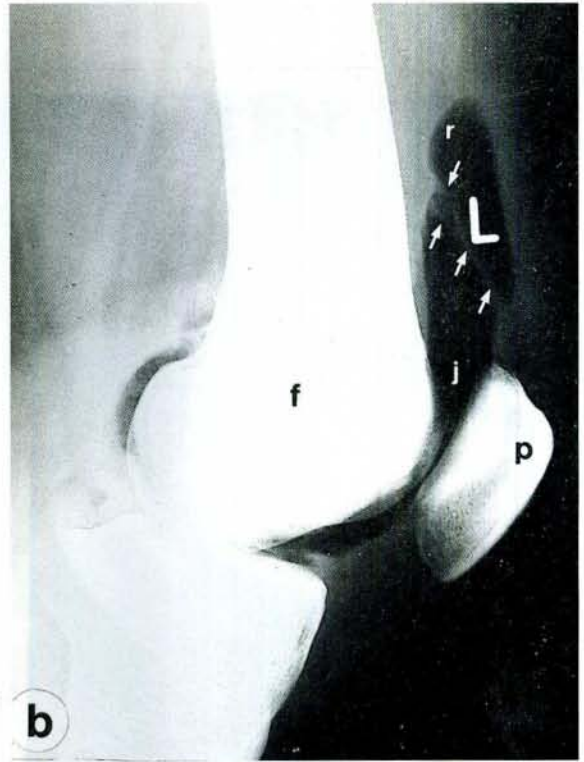
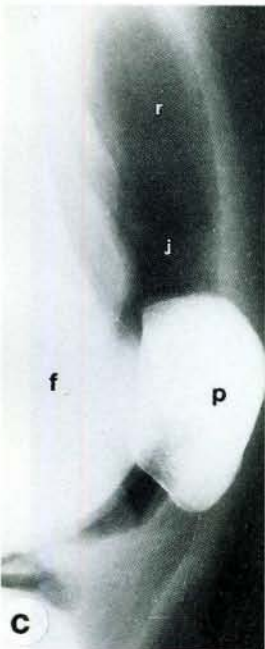
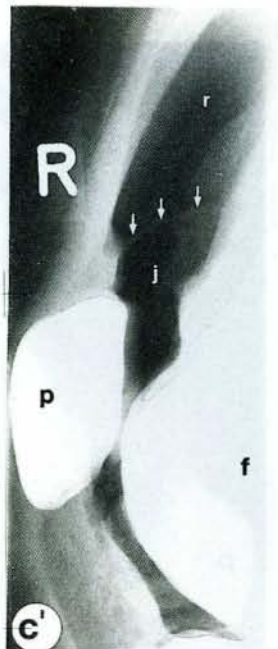


Fig. 3b



Figur 3c



Figur 3d

Fig. 3 a : Pneumarthrograph of a right knee joint (R); the suprapatellar septum (arrows) completely separates the joint cavity (j) from the suprapatellar bursa (p=patella, f=femur, t=tibia).

b. Left knee joint (L); knee-joint cavity (j) and suprapatellar recess (r) communicate via a perforation in the septum. The opening is demarcated by the septum portions (arrows).

c. Residual septum of a right knee joint (R) at the medial side. The septum is distant from the film and cannot be demonstrated (c). After rotating the leg by 180°, septum (arrows) is orientated towards the film and can be demonstrated (c').

d. No septum structure can be identified. Joint cavity and suprapatellar recess (r) are one space.



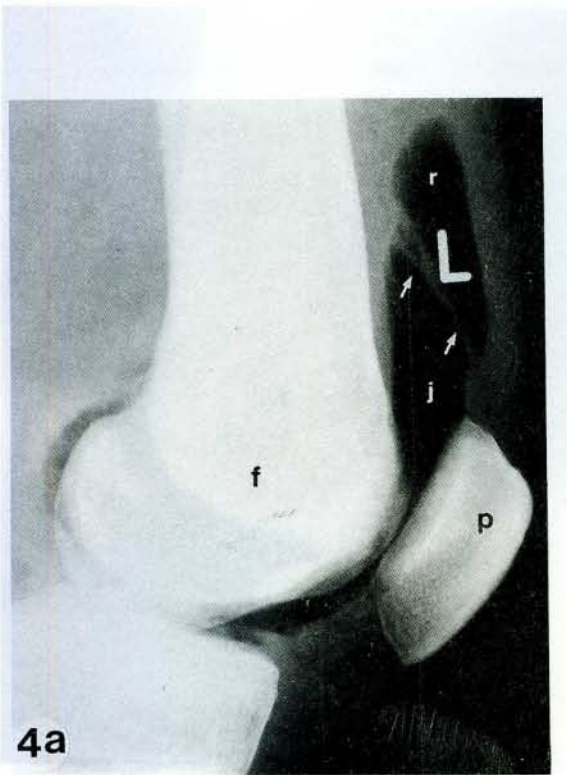


Fig. 4a

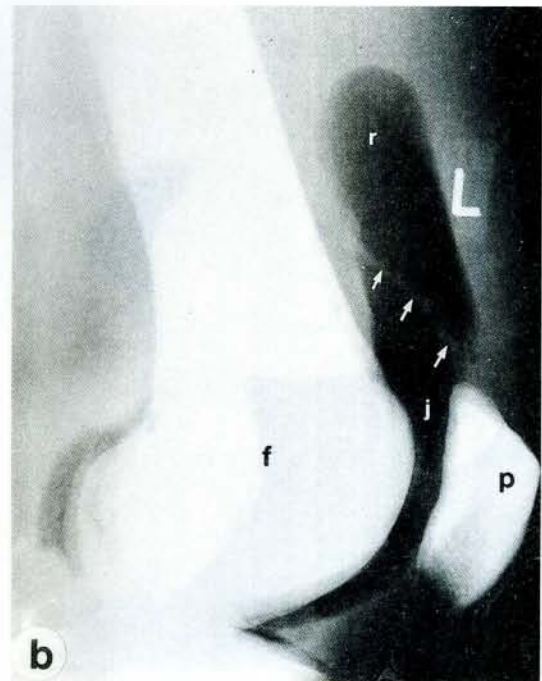
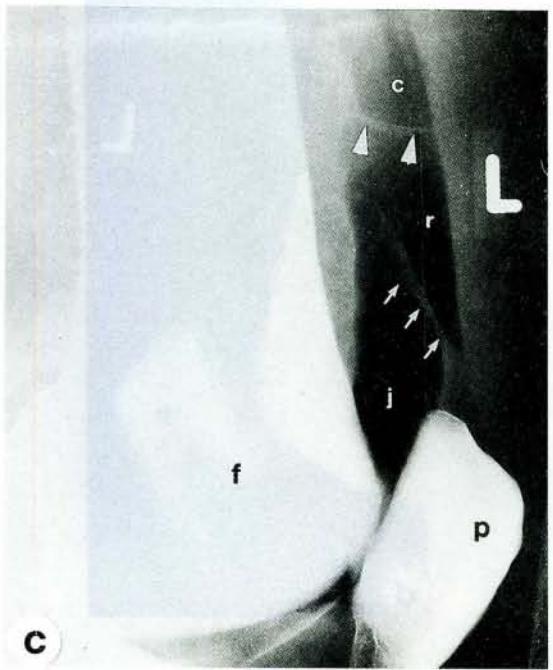
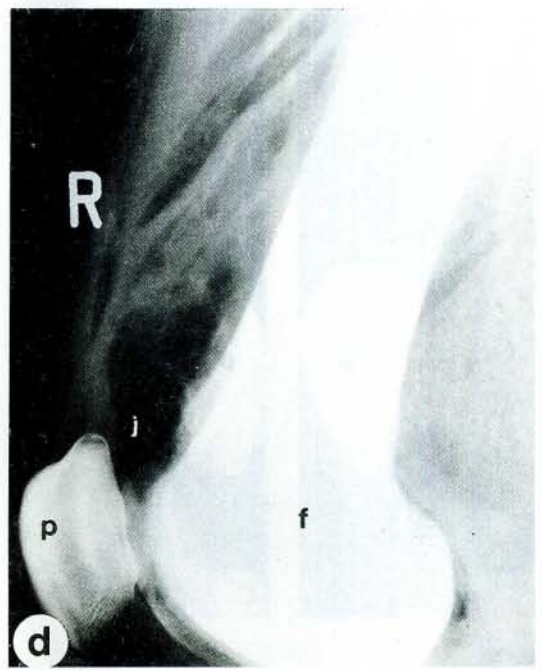


Fig. 4b



Figur 4c



Figur 4d

Fig. 4: a. Normal extension of the suprapatellar recess (r).  
b. Distension of the suprapatellar recess  
c. Dissection cyst (c) proximal to the suprapatellar recess (r). Arrows indicate the suprapatellar septum between joint cavity (j) and suprapatellar recess (r), arrowheads mark the line separating the suprapatellar recess from the dissection cyst.  
d. Rupture of the suprapatellar pouch with pseudocyst formations in the suprapatellar soft tissue.

and European people concerning the synovial folds of the knee joint.

The unilateral existence of an additional suprapatellar recess is common in literature.

### Suprapatellar cysts

The capsule of the knee joint cavity is protected over most of its extent by bone or tendons. There are two vulnerable sites, first of them at the back of the knee, the other weak point is the apex of the suprapatellar pouch (2, 4, 5).

In this regard, the pathology of the suprapatellar pouch can be similar to that of popliteal Baker's cyst (23, 36). Increased intraarticular pressure can cause distension, dissection (35) or rupture (24) of the suprapatellar recess (Fig. 4a-d).

### Conclusions

Considering ontogenesis, all known variations of the suprapatellar septum can be classified into 4 types.

The terms "suprapatellar plice" and "suprapatellar septum" should not be used synonymously, since the suprapatellar plice is only one of the four types of the suprapatellar septum.

An additional saccular space on the level of the suprapatellar pouch exists only at the medial side.

Increased intraarticular pressure can cause distension, dissection or even rupture of the suprapatellar pouch. This should be taken into account if suprapatellar pain occurs.

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