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Technical Notes

The Relationship Between the Common Femoral Artery, the Inguinal Crease, and the Inguinal Ligament: A Guide to Accurate Angiographic Puncture

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Abstract. The variability of the extraperitoneal puncture space between the inguinal ligament and the inguinal crease was evaluated in 100 patients. The distance between the inguinal crease and the inguinal ligament varied from 0 to 11 cm (average 6.7 cm ± 1.9 SD), the average value for women (7.5 cm ± 1.9 SD) being significantly greater than that for men (6.3 cm ± 1.9 SD, p = 0.0128). The bifurcation of the common femoral artery was found below the inguinal crease in 20%, at the same level in 3.5%, and above it in 76.5% of cases. Consideration of these results will help avoid intraperitoneal puncture and improve the rate of successful antegrade puncture of the femoral artery.

Key words: Angiography—Angiography, complications—Angiography, technology—Artery, femoral—Antegrade puncture

The inguinal crease is an important anatomical reference point for retrograde and antegrade puncture of the femoral artery in angiographic procedures. As a rule, the needle is inserted at or just below the inguinal crease in order to avoid peritoneal complications. However, there are no precise anatomical data available supporting this practical approach. In addition, it is preferable to puncture the common femoral artery before it branches [1]. For this reason, the topographical relationship of this vessel and its site of branching relative to the inguinal crease is of practical significance [2]. This applies particularly to antegrade puncture in the case of interventional procedures within the superficial femoral artery [3–6]. The present paper is based on a prospective radiological study to achieve the following objectives: 1) to investigate the extent of the extraperitoneal puncture space above the inguinal crease which is limited cranially by the inguinal ligament (lower border of the abdominal cavity); 2) to determine the level of the common femoral artery division into its main branches (superficial and deep femoral arteries) with reference to the inguinal crease and to learn how often the common femoral artery is likely to be punctured with a typical angiographic approach.

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Patients and Methods

In 100 patients (68 men, 32 women) undergoing angiography for peripheral vascular occlusive disease, the inguinal crease was marked on both sides with a long metal needle. The femoral artery was punctured just below the inguinal crease in the usual manner. The inguinal ligament was assumed to be at the level of the origin of the deep circumflex iliac artery, which originates from the lateral wall of the external iliac artery at the level of the ligament, coursing laterally along its dorsal surface [7–11]. It was possible to clearly identify the deep circumflex iliac artery in the arteriograms of 85 patients (59 men, 26 women) who had arteriograms of both legs (170 legs). The following measurements were carried out: 1) The distance between the inguinal crease (marked by a needle) and the inguinal ligament (deep circumflex iliac artery, 170 legs). In 5 patients the inguinal ligament was also marked intraoperatively by metal clips and the distance to the inguinal crease was measured on a postoperative angiogram. 2) The distance between the branching point of the common femoral artery and the inguinal crease (200 legs). In the absence of a common deep circumflex trunk (deep femoral artery in the usual sense), the largest caliber vessel was assumed to be the branching point. The extraperitoneal section of the pelvic artery, until it divides into the superficial and deep femoral arteries, is called the common femoral artery in vascular surgery. 3) It was also determined in each case whether the common femoral artery or one of its major branches was punctured.

The parallax error occurring during serial angiography (the central beam of the tube was aimed at the sacral promontory during the first phase of angiography) was not taken into consid-

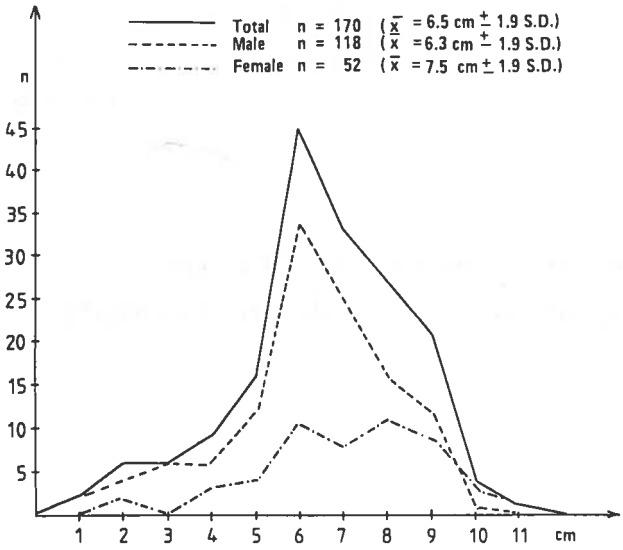

Fig. 1. Graphic representation of the extraperitoneal inguinal puncture space. Abscissa: distance (cm) between inguinal crease and inguinal ligament. Ordinate: number of patients (n = 170).

eration, and neither was the magnification factor of about 10–15% (film focus distance 135 cm).

Results

There was a significant variation in the distance between the inguinal crease and the inguinal ligament, which varied from 0 to 11 cm (n = 170) (Fig. 1). The average distance was 6.5 cm ± 1.9 SD. The average distance in the female patients was significantly larger statistically (7.5 cm ± 1.9 SD) than among the male patients (6.3 cm ± 1.9 SD, p = 0.0128, Wilcoxon 2-sample test). Only in eight (4.7%) of 170 legs was the inguinal crease in the immediate vicinity of the inguinal ligament or less than 2 cm away from it (Fig. 2). In 18.3% of cases, this distance was 3–5 cm. In the majority of cases (61.7%), the distance from the inguinal ligament was 6–8 cm (Fig. 3). The distance was greater than 8 cm in 15.3% of cases, and the greatest distance measured was 11 cm.

A graphic representation clearly illustrates the great variation of the extraperitoneal puncture space (Fig. 1). The discrepancy of 1 cm between the deep circumflex iliac artery and the metal clips positioned intraoperatively was due to the fact that the lower border of the inguinal ligament was marked in the course of the extraperitoneal operations.

Branching of the deep circumflex iliac artery from the common femoral artery was found to be constant within a distance of 2 cm distally from a horizontal line drawn through the craniolateral part

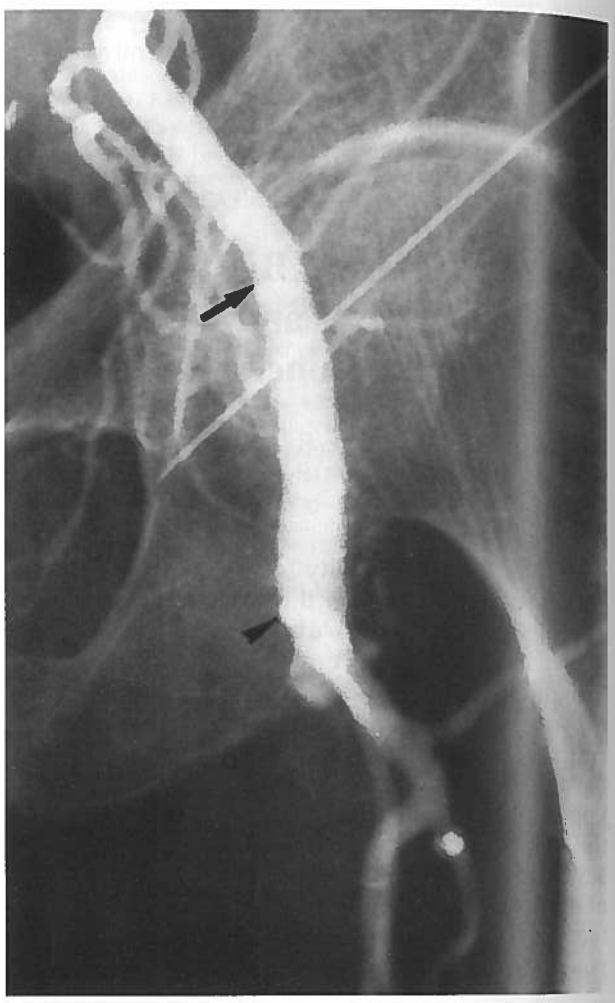

Fig. 2. Small extraperitoneal puncture space with a distance of only 1 cm between the inguinal ligament (deep circumflex iliac artery →) and the inguinal crease, marked by a needle. The common femoral artery branches 4 cm beneath the groin (arrowhead). There is occlusion of the superficial femoral artery.

of the hip joint space. Therefore, it is possible to estimate the level of the inguinal ligament and the beginning of the common femoral artery on a plain film or fluoroscopically (Figs. 2–5).

Branching of the superficial and deep femoral arteries was below the inguinal crease in 40 cases (20%), exactly at the level of the inguinal crease in 7 (3.5%), and above it in 153 (76.5)% (Table 1). In all 200 legs (100 patients) the branching took place most frequently (63%) 1–4 cm above the inguinal crease (Fig. 3), whereas in only five legs (2.5%) was there an exceptionally high proximal division (7–10 cm, Fig. 5). Below the inguinal crease the branching point was most often at a distance of 2 cm, but in some cases it was distally as far as 10 cm below the inguinal crease (Fig. 2).

In 72 patients, the site of puncture was the com-

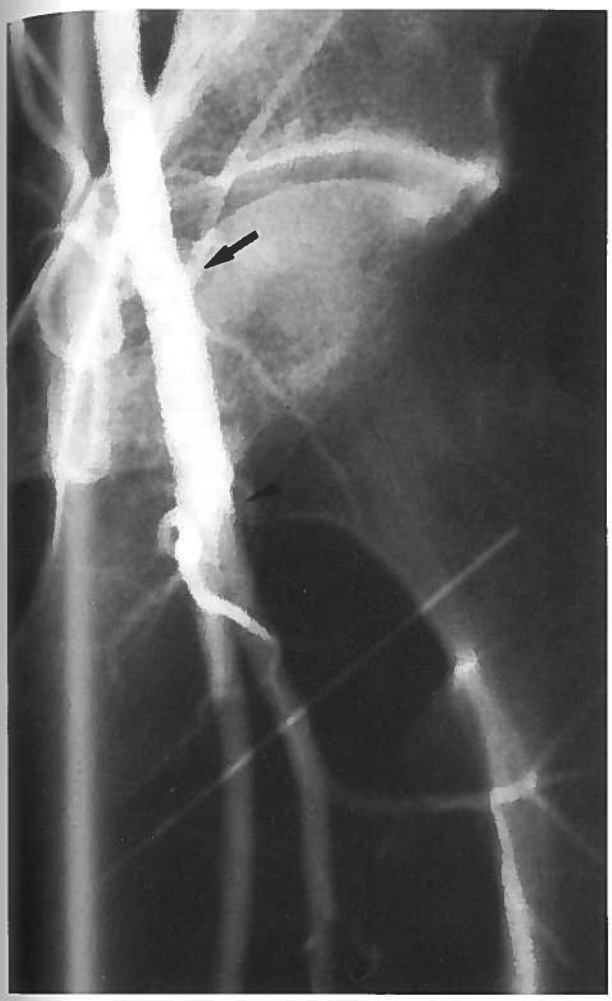

Fig. 3. Large extraperitoneal puncture space with a distance of 7 cm between the inguinal ligament (deep circumflex iliac artery ←) and the marked inguinal crease. The common femoral artery branches in the middle of the puncture space 3 cm above the inguinal crease (arrowhead).

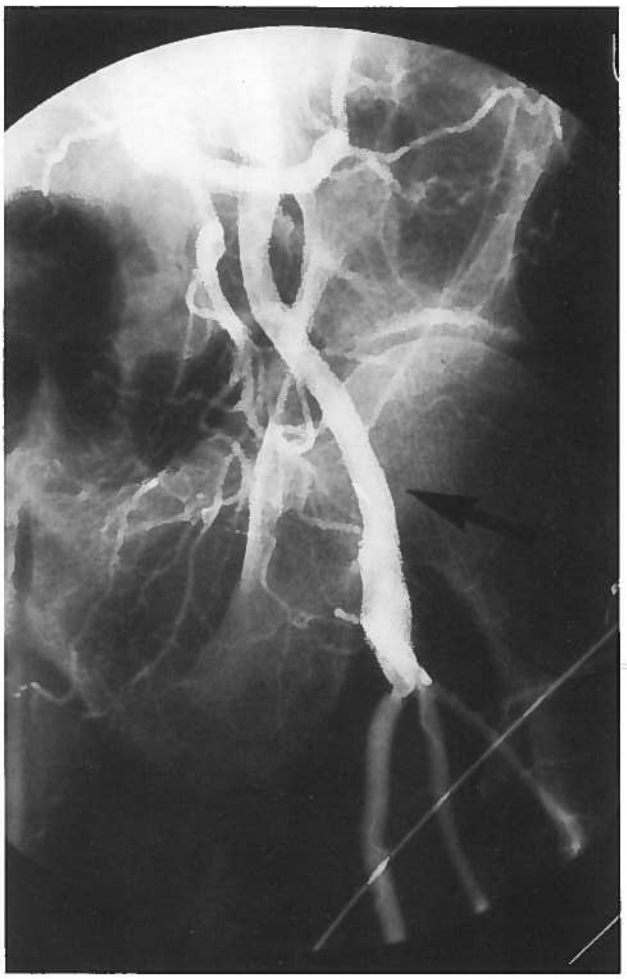

Fig. 4. Postoperative angiography after interoperative marking of the lower border of the inguinal ligament. The metal clip partly covered by the contrast-filled artery (←) is about 1 cm below the origin of the deep circumflex iliac artery. A trifurcation of the common femoral artery is 2 cm above the inguinal crease.

mon femoral artery, in 15 the superficial femoral artery, and in 13 the deep femoral artery.

Discussion

The inguinal ligament, which forms the caudal limit of the abdominal cavity, cannot be defined radiologically. It extends from the anterior superior iliac spine to the pubic tubercle and is convex caudally [8]. The inguinal ligament represents a central strand of connective tissue and can only be artificially separated from its surrounding fibrous tissue. It is thus impossible to determine the exact width of the inguinal ligament.

The inguinal crease is the most frequently used puncture site for arterial angiographic investigations and interventional procedures. The femoral artery is generally punctured at or just below the inguinal crease to avoid possible intraperitoneal complications and with the idea of puncturing the large-caliber common femoral artery [12]. This consideration is based on the idea that the inguinal crease is closely related to the inguinal ligament and can therefore be taken as an approximate reference point for this structure.

The present investigation has shown that the inguinal crease usually does not represent the level of the inguinal ligament and in most cases is not intimately related to the lower border of the abdominal cavity. There is a considerable distance between the inguinal crease and the inguinal ligament, which offers, in the great majority of cases, ample space for a safe extraperitoneal puncture. This greatly re-

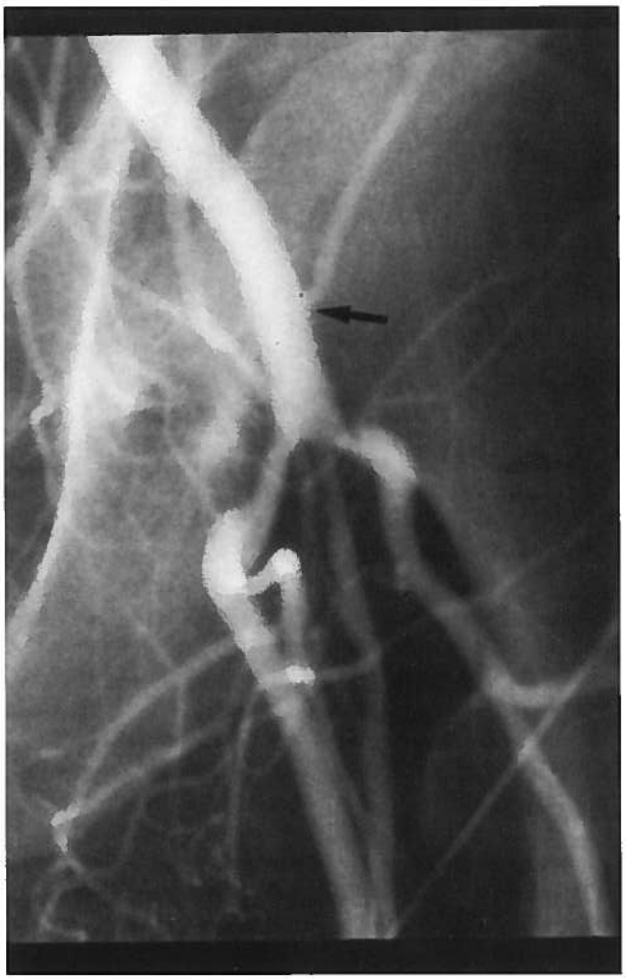

Fig. 5. Large 8 cm-extraperitoneal puncture space (origin of the deep circumflex iliac artery ←). High division of the common femoral artery 1 cm below the inguinal ligament. In this situation, puncture of the superficial femoral artery is likely to be performed.

duces the possible complications of an unintentional abdominal puncture even if the needle is introduced at an angle (Fig. 1). Only in a minority of cases 8/170 (4.7%), was the inguinal crease in the intimate vicinity of the inguinal ligament (0–2 cm); in the remaining cases (95.3%), a distance of 3–5 cm was available for puncture. This explains the fact that intraperitoneal or retroperitoneal puncture is rare and usually can be avoided if the needle is not angled too obliquely. A very close relationship between inguinal crease and inguinal ligament certainly increases the risk of an abdominal complication, although in practice this situation is infrequently encountered.

It is desirable to puncture the common femoral artery because of its large caliber. This can be easily achieved in 23.5% of patients whose femoral artery branches at the level of, or just below, the inguinal

Table 1. Distance between the division of the common femoral artery and the inguinal crease (I.C.)

Distance (cm)	Occurrence	Percentage relative of I.C.
+7/+10	5	
+6	11	
+5	11	
+4	32	76.5%
+3	33	
+2	37	
+1	24	
I.C.	7	3.5%
−1	8	
−2	13	
−3	6	20%
−4	6	
−5/−10	7	
Total	200	100%

crease. In the majority of cases (76.5%), the branching takes place at a varying distance above the inguinal crease, so that it is likely that the superficial or deep femoral artery will be punctured (Fig. 1). In view of the fact that the puncture space is larger than 5 cm in 67% of cases, and that in 63% of cases the vessel branches above the inguinal crease within a distance of 4 cm, the common femoral artery will probably be punctured by the standard procedure in the majority of cases.

If on the other hand, a wide puncture space with a high branching immediately below the inguinal ligament is present, it is unlikely that the common femoral artery will be punctured (Fig. 5). As our material shows, a puncture of one of the major branches of the common femoral artery can be expected in about 25% of cases.

A practical benefit of our investigation is that antegrade puncture of the superficial femoral artery, often a difficult procedure in angiographic intervention, can be easily facilitated. Zeitler [13] stated that 5% of the superficial femoral artery punctures were not successful, and in another 10%, initially the deep femoral artery was punctured.

The potential puncture space can be estimated prior to angiography by measuring the distance of the inguinal ligament (joint space of the hip minus 1 cm) to the marked inguinal crease. An antegrade puncture of the femoral artery should be performed in the cranial half of the puncture space in order to increase the probability of puncturing the common

femoral artery before it branches, and at the same time avoiding abdominal complications.

References

1. Grossman M (1974) How to miss the profunda femoris. Radiology 111:482
2. Dotter ChT, Rösch J, Robinson M (1978) Fluoroscopic guidance in femoral artery puncture. Radiology 127:266–267
3. Berman HL, Katz SG, Tihansky DP (1986) Guided direct antegrade puncture of the superficial femoral artery. AJR 147:632–634
4. Bishop AF, Berkman WA, Palagallo GL (1985) Antegrade selective catheterization of the superficial femoral artery using a movable core guide wire. Radiology 157:548
5. Kikkawa K (1984) A new antegrade femoral artery catheter needle set. Radiology 151:798
6. Saddekni S, Srur M, Cohn DJ, Rozenblit G, Wetter EB, Sos TA (1985) Antegrade catheterization of the superficial femoral artery. Radiology 157:531–532
7. Benninghoff A, Görtler K (1979) Lehrbuch der Anatomie des Menschen, vol II: Eingeweide und Kreislauf. Ferner H., Straubesamt J. (eds). Urban and Schwarzenberg, Munich, Vienna, Baltimore, p. 458
8. Gray's Anatomy. 36th Ed (1980) Williams PL, Warwick R (eds). WB Saunders, Philadelphia. pp 552, 723–725
9. Becker RF, Wilson JW, Gehweiler JA (1971) The anatomic basis of medical practice. Williams and Wilkins, Baltimore, pp 714–716
10. Snell RS (1973) Clinical anatomy for medical students. Little, Brown and Co, Boston, p 121
11. Haferl A (1969) Lehrbuch der topographischen Anatomie. 3. Aufl. Springer-Verlag, Heidelberg, New York, p 399
12. Rappaport S, Sniderman KW, Morse SS, Proto MH, Ross GR (1985) Pseudoaneurysm: A complication of faulty technique in femoral artery puncture. Radiology 154:529–530
13. Zeitler E (1975) Die selektive Katheterangiographie der Arteria femoralis superficialis: Technik, Komplikationen und Möglichkeiten der Differentialdiagnose und -therapie. Elekto Medica 5:167–178