Angiographic evaluation of a new technique for common femoral artery access: The inguinal ligament-guided approach

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Common femoral artery (CFA) access has been proved to be safe with lower risk of complications in percutaneous catheterizations [1–3]. Several femoral puncture techniques have been proposed with the purpose of increasing the rate of CFA access [1,4,5], but a more simple, practical, and reliable approach is demanded.

The inguinal ligament, linking between the anterior superior iliac spine and pubic symphysis and representing the superior borderline of CFA, might offer a palpable and reliable reference for CFA cannulation [6]. This study sought to introduce a new technique for CFA access based on the inguinal ligament and propose a new method of inguinal division to evaluate this approach on femoral angiograms.

Between June 2008 and May 2011, patients undergoing transfemoral cardiac catheterization and planning for use of vascular closure devices (VCDs) were consecutively enrolled. All patients gave written informed consent before enrollment. The femoral arteries were cannulated via the inguinal ligament-guided approach: After delineating the course of the femoral artery, the inguinal ligament was located by palpitation of the anterior superior iliac spine and pubic symphysis. The left medius was then positioned at the intersection of inguinal ligament and femoral artery. Thereafter, the left forefinger close to the medius was placed on the femoral artery, and artery puncture was performed at the inferior margin of the forefinger at 45° parallel to the course of the femoral artery (Fig. 1).

By the end of catheterization, ipsilateral femoral angiograms (right anterior oblique 30°+cranial 20°) were routinely performed for inguinal division. The femoral head and pubic symphysis were used for landmarks. The inguinal region was divided by 3 lines. The first line was drawn between the superior margin of the femoral head and the midpoint of pubic symphysis. The second line parallel to the first line was just at the inferior margin of the femoral head. The third parallel line was at the middle of the first and second lines. The inguinal region was divided into zones A, B1, B2 and C. Zone B (including B1 and B2) was between the first and second lines (the femoral head zone) (Fig. 1). All femoral angiograms were reviewed to evaluate the location of the femoral artery cannulation and the use of VCDs (Fig. 2). All analyses were performed using the SPSS version 16.0.

The study protocol conforms to the ethical guidelines of the 1975 Declaration of Helsinki as reflected in a priori approval by the institution’s human research committee. The authors of this manuscript have certiﬁed that they comply with the Principles of Ethical Publishing in the International Journal of Cardiology.

A total of 822 cases (64.2% male; mean age 59.6±10.2 years) were recruited. 6 F arterial sheath was used in 92.9%. Femoral bifurcation was located in zones A, B1, B2 and C in 0.2% (2/822), 4.6% (38/822), 43.1% (354/822) and 52.1% (428/822) of cases, respectively. In 96.8% (796/822) of cases, femoral arteries were punctured in zone B, of which 36.0% (296/822) in zone B1 and 60.8% (500/822) in zone B2.

The total success rate of CFA access was 82.8% (681/822). When femoral artery puncture sites located in zones B, B1, B2 and C, CFA access was acquired in 83.9% (668/796), 91.6% (271/296), 79.4% (397/500) and 40% (8/20) of cases, respectively.

VCDs were used in 82.1% (675/822) of cases. The total rate of vascular complications during hospitalization was 1.0% (8/822). In patients using

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1 These authors take responsibility for all aspects of the reliability and freedom from bias of the data presented and their discussed interpretation.
VCDs, the incidence of vascular complications was 0.3% (2/675), including 1 retroperitoneal hematoma and 1 arteriovenous fistula.

Our study presented a new technique for CFA access based on the inguinal ligament. Whereas zone A represented the area above the inguinal ligament, zone B (zone B₁ + B₂) acted as the optimal area of the femoral artery puncture. When the artery puncture site was in zone B, the rate of CFA puncture was 91.6%, indicating enhanced safety compared with zone B (83.9%). Furthermore, our study showed a lower incidence of vascular complications (1.0%) compared with other studies [2,7], especially in patients using VCDs (0.3%).

Currently, no standard division of inguinal region is uniformly accepted. Schnyder et al. [4] used the femoral head, including its inferior border and center, as a landmark to divide the inguinal region into 3 zones (Fig. 3A). This method is relatively simple, but the borderlines are not vertical to the CFA, resulting in the difficulty in localization of puncture site. Garrett et al. [5] divided the inguinal region into 4 zones in relation to the inguinal ligament, the femoral head, and the inguinal skin crease (Fig. 3B). However, the levels of bony structure as well as the inguinal skin crease show a wide disparity among individuals. Huggins et al. [1] used four parallel borderlines to divide the femoral head area into 5 zones (Fig. 3C). However, the proximal third of the femoral head is possible to be superior to the femoral ligament, indicating high rate of vascular complications.

In the present study, we firstly used the femoral head and pubic symphysis as landmarks to divide the inguinal region into zones A, B₁, B₂ and C (Figs. 1 and 3D). This new method shows the following advantages. First, the borderlines are almost parallel to the inguinal ligament, which better delineates the relationship between the femoral artery and inguinal ligament. Second, the bony structures including the femoral head and pubic symphysis provide relatively fixed borderlines compared to the inguinal skin crease. Third, the borderlines are almost vertical to the femoral artery which allows for accurate identification of femoral bifurcation and artery puncture site.

In conclusion, we demonstrated that the novel inguinal ligament-guided approach is simple and reliable for CFA access. Femoral puncture between the superior and inferior margins of the femoral head predicts higher success rate of CFA access. In addition, we proposed a new method of inguinal division, which effectively defines the relationship between the femoral artery and inguinal ligament.

References

Fig. 3. Different methods of inguinal division. (A) Schnyder et al. [4] used the femoral head, including its inferior border and center, as a landmark to divide the inguinal region into 3 zones. (B) Garrett et al. [5] divided the inguinal region into 4 zones in relation to the inguinal ligament, midpoint and inferior margins of the femoral head, and the inguinal skin crease. (C) Huggins et al. [1] used four parallel borderlines to divide the femoral head area into 5 zones, namely the area superior to the femoral head, the proximal third, middle third and distal third of the femoral head, and the area inferior to the femoral head. (D) The inguinal division used in this study. Detailed descriptions are showed in Fig. 1.