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ANATOMIC BASES OF MEDICAL, RADIOLOGICAL AND SURGICAL TECHNIQUES

# Y sign: new landmark for anteromedial portal placement in knee arthroscopy

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## Abstract

**Purpose** During arthroscopy training process, determination of anteromedial portal is more difficult in contrast with anterolateral portal and frequently results in suboptimal position, and longer operating times. The aim of our study was to identify an anatomical landmark which could facilitate anteromedial portal placement.

**Methods** The relationship of the cutaneous veins at the anteromedial side of the knee was analysed regarding the optimally placed anteromedial portal and anatomical landmarks of the anteromedial part of the knee in 70 patients undergoing knee arthroscopy. The study was designed as case series.

**Results** In 70% of the patients, the joining of the cutaneous veins was seen after transillumination resembling Y letter. In the remaining 30% of patients, a solitary vein with a curve which corresponds to the joining point was observed. The curve and the joining was located adjacent to optimally placed anteromedial portal measured 2 cm ± 0.3 from the medial patellar tendon border, and 1.1 cm ± 0.1 from the palpable edge of the medial tibial plateau.

**Conclusions** The "Y sign" can assist knee arthroscopy trainees in anteromedial portal placement, with the resulting avoidance of multiple puncturing of the skin with the needle, shorter operating room times to find the optimal portal placement, and potential reduction of damage to intraarticular structures.

**Keywords** Arthroscopy · Knee · Anteromedial portal · Landmarks

## Introduction

Knee arthroscopy is one of the most frequently performed procedures in orthopaedic surgery with a variety of indications. It is a powerful tool that should today be included in every orthopaedic surgeon's arsenal. However, gaining skill in arthroscopic procedures is no easy task as it takes a great deal of patience and persistence, so any and every help is welcome during the training period. Good portal placement is paramount to perform a successful procedure. In our experience, placement of the anterolateral portal is fairly easy due to clearly visible landmarks in most patients and well-defined boundaries of the lateral "soft spot" (found just lateral to the patellar tendon). Given that the anterolateral portal offers the largest field of view [3], a suboptimal portal placement here is better tolerated. Placing the anteromedial portal, found medial to the patellar tendon, however, can be more difficult for beginners since the anatomical landmarks are less visible there, especially when the knee is filled with fluid after the camera is introduced in the knee, or with patients who are obese. Furthermore, the anteromedial portal is the main working portal, so even the slightest portal malpositioning may result in a difficult approach to the desired structure and subsequent scuffing of the articular cartilage [4]. The aim of our study was to identify a landmark which could facilitate anteromedial portal placement during knee arthroscopy training.

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## Materials and methods

The anatomy of cutaneous veins in the anteromedial region of the knee was evaluated in 70 patients undergoing knee arthroscopy. All patients signed our institution's form of consent for surgical and anaesthesiologic procedure. They have also indicated willingness to participate in our study and gave permission to use their data by ticking the optional box on the form after the nature and methodology of the study was explained to them. No previous surgery had been performed on the knee in any of the cases. All surgeries were performed by the first and the second authors. The study was designed as case series. After 4 min of leg elevation, a tourniquet was placed around the thigh and inflated. The leg was placed in a leg holder secured with a strap [7]. After preoperative scrubbing and draping, the knee was placed hanging freely from a leg holder in 70°–80° flexion (Fig. 1). Using the surgical pen, the medial border of the patellar ligament, the border of the medial tibial condyle and the medial femoral condyle were marked (standard anatomical landmarks) (Fig. 2).

A high anterolateral portal was made in the standard manner in zone A (anterolateral capsulosynovial layer) [1] and an arthroscopic camera was introduced into the knee.

The anteromedial area of the knee was illuminated with the arthroscope revealing either a cutaneous venous joining with usually two veins or, less frequently, a single vein in this region in all patients. The venous joining or the single vein closest to the medial patellar tendon border was marked with the surgical pen and the shortest distance in relation to the medial border of the patellar tendon and the palpable border of the medial tibial plateau was measured with a sterile surgical ruler. After that, under direct visualisation with the arthroscope, the 18-gauge needle was introduced in optimal position of the anteromedial portal (Figs. 3, 4). The position of the needle representing optimal anteromedial portal position and the venous joining or vein curve was evaluated.

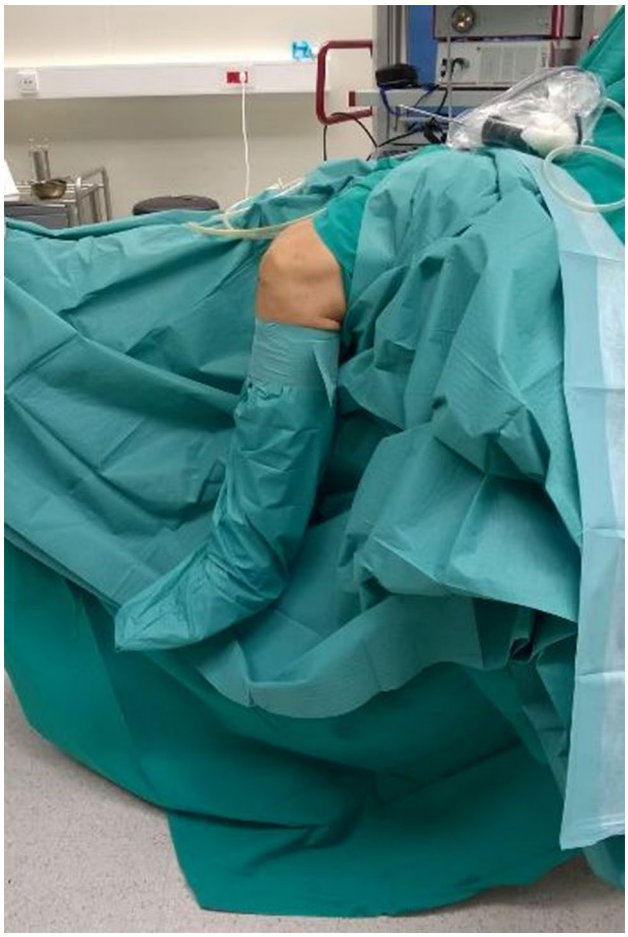

**Fig. 1** Leg position in holder

## Results

Seventy patients participated in our study (42 males and 28 females, mean age 49 ± 3.21 years, range 18–66 years). The venous joining in the region of the anteromedial soft spot consisted of two branches in 70% of the cases (49 patients), while in 30% of the patients (21 patients) a single vein with a curve convex towards the tibia was seen. The shortest distance of the marked venous joining or venous curve was 2 cm ± 0.3 cm (range 1.8–2.5 cm) from the medial patellar tendon border, and 1.1 cm ± 0.1 cm (range 1–1.5 cm) from the palpable edge of the medial tibial plateau. In the case of a solitary vein, we observed that position of the curve corresponded to the position

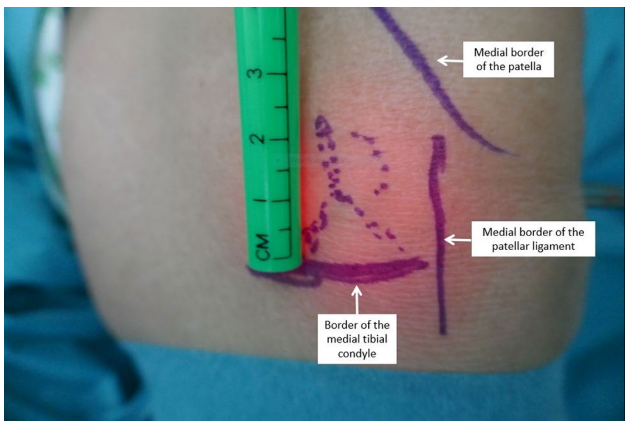


**Fig. 2** Marking of the anatomical landmarks and venous joining; determining the distance of the venous joining from the anatomical landmarks

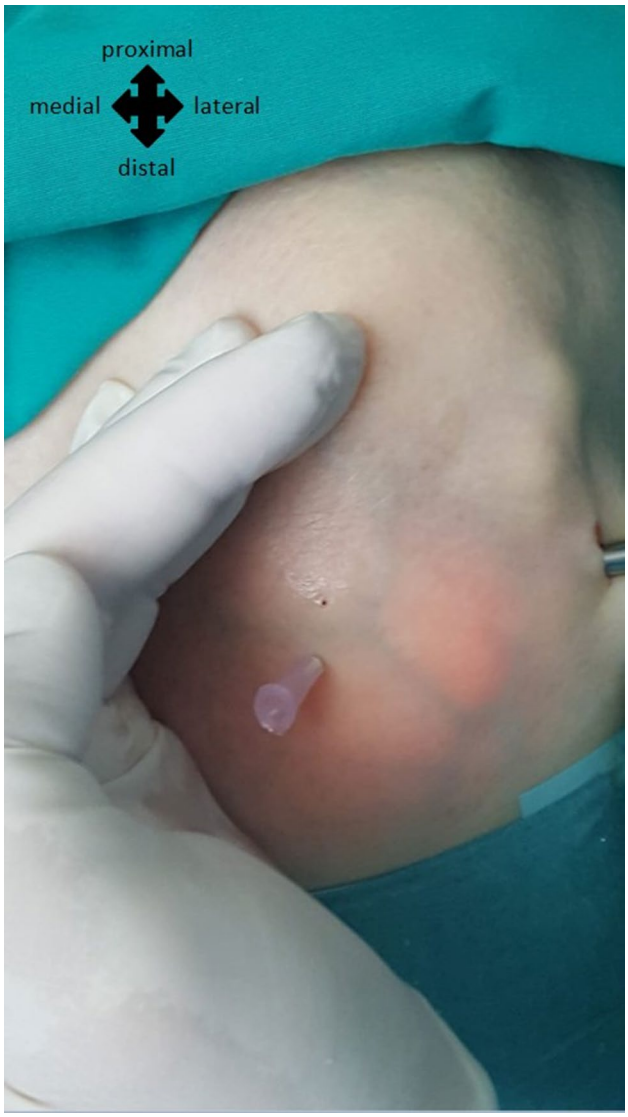


**Fig. 3** Needle placed at the joining of cutaneous veins

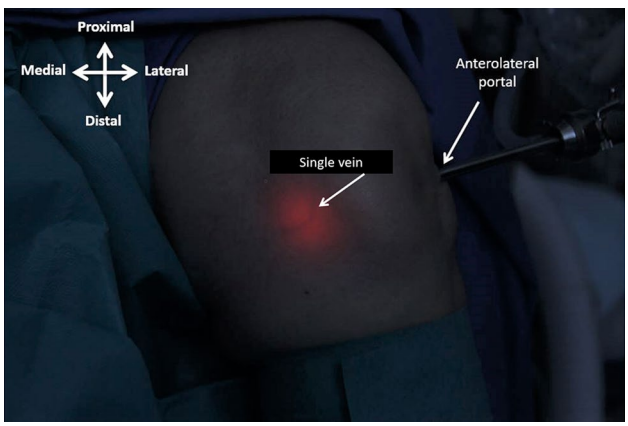


**Fig. 4** Variation with a single vein in the area of the anteromedial portal

of the venous joining in those patients with two veins. In the cases of a venous joining, the circle formed around it by illumination with the arthroscope revealed that it resembled the inverted letter Y, which is why it was consequently named the "Y sign" (Figs. 5, 6).

In all patients, when the needle was introduced just distal and medial to the venous joining, or to the venous curve in patients with a single vein, it became situated intraarticularly immediately above the meniscus without damaging the bone or articular surface. In 40% of the patients (28 patients), the position of the needle was slightly corrected (repositioned slightly more medially or laterally) to achieve optimal positioning regarding intraarticular pathology, the correction being done under arthroscopic observation.

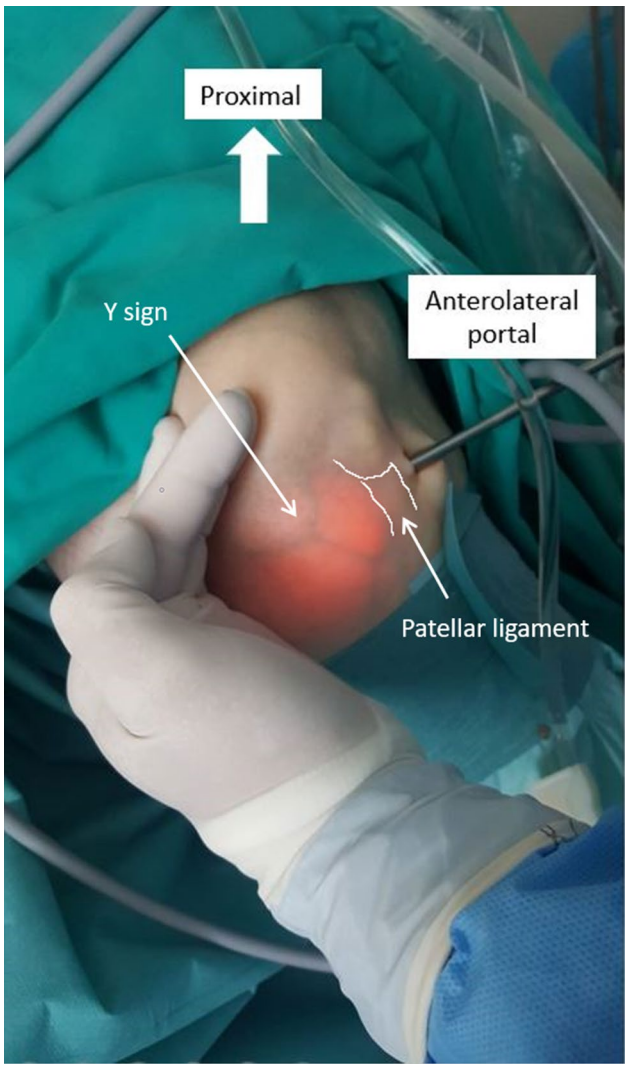


**Fig. 5** Venous joining transilluminated

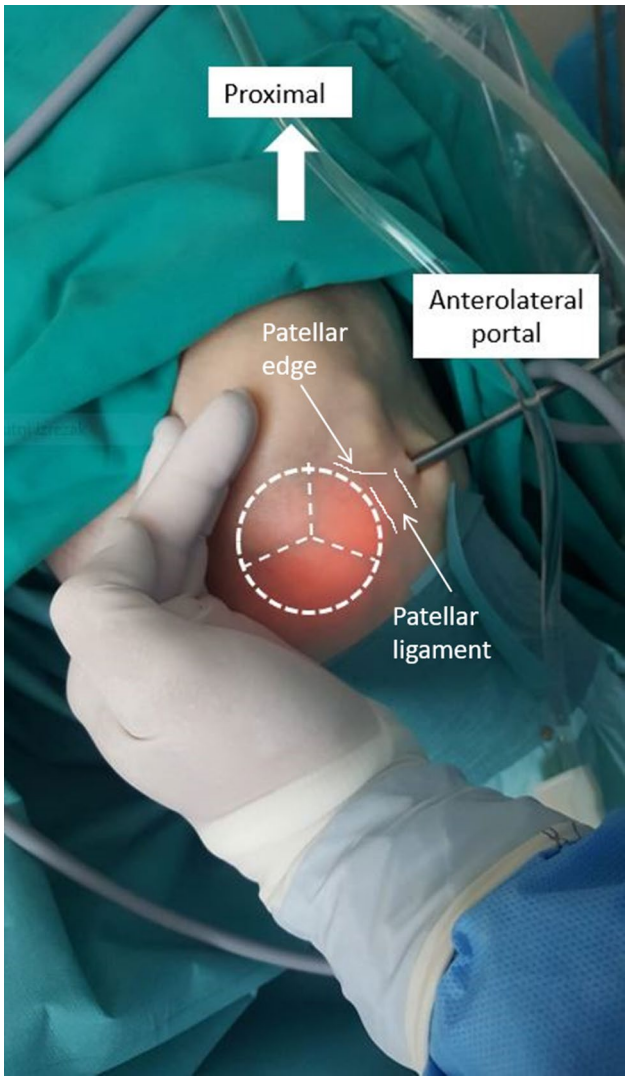


**Fig. 6** The veins and the circle of light from the arthroscope accentuated

## Discussion

In our study group, we found that in the area of anteromedial portal, all patients had easily visualised cutaneous venous joining or a single vein with a distinct curve. Regardless of which was present, their positions were quite constant relative to the medial borders of the patellar tendon and the medial tibial condyle with knee flexion between 70° and 80°.

The technique for anteromedial portal placement is well described in the literature [8], with the portal placed under direct vision using the arthroscope while palpating the region for the desired anteromedial portal site. Once the desired position is found, the needle probe should be introduced to verify the position. We observed, however, that beginners often struggle with this placement, even after successfully palpating the soft spot. During the training programme offered in our institution we noticed that, prior to finding the optimal anteromedial position, trainees generally made multiple hits to the bone, the meniscus or the cartilage with the needle, with possible damage to the structures, especially to the cartilage. On an average, 20 young doctors go through our training programme per year, each performing 30 knee arthroscopies during their stay. Given that knee arthroscopy is a common procedure during residency, such minor tissue injuries are likely to occur during the learning process.

We found that the use of the "Y sign" in combination with palpation is very beneficial as a new landmark for needle probe placement while practicing for anteromedial portal placement. Indeed, when the needle was inserted in the vicinity of the centre of the "Y sign" (the venous joining or venous curve), in 100% of the cases it was placed intraarticularly at the first attempt without damaging the intraarticular structures, which is very important since patient safety is a recognised issue during surgical training [6]. In 40% of the cases, only a minor correction of the position was needed regarding intraarticular pathology, which was achieved under direct vision with the arthroscope and without any subsequent damage to the cartilage or the bone. When positioning the anteromedial portal just lateral and below the "Y sign" as the landmark, we found the horizontal position of the anteromedial portal to be a little farther from the medial border of the patellar ligament than reported in the literature (2 vs 1 cm) [8]. This could also be helpful to beginners because in this case the handles of surgical instruments are positioned further apart from each other, which facilitates the application of the arthroscopic principle of triangulation (the instrument introduced through the anteromedial portal was brought into the optical field of the arthroscope, with the tip of the instrument and the arthroscope forming the apex of a triangle) [2] and the subsequent orientation inside the joint.

There are some limitations to this study. First of all, the surgeries were not performed together by the authors, so the assessment of agreement regarding the portal placement between them could not be carried out. Furthermore, although we had a rather adequate sample size, we must acknowledge that our findings may not be generalisable to all patients. Having all this in mind, it is clear that future studies should address these issues.

The landmark we describe may not be indispensable to experienced surgeons because they use other orientation points depending on their own experience and personal preferences. However, although their landmarks may be more accurate or reliable, they are also more difficult for trainees to identify and use during their learning process in comparison with the Y sign.

## Conclusion

In our study we found the "Y sign" to be a very useful landmark for anteromedial portal placement during arthroscopy training. This placement facilitates arthroscopic triangulation during training and prevents positioning the portal too close to the patellar tendon, which can limit the freedom of movement of the instruments [5]. Using the "Y sign" could significantly shorten the learning curve and make the procedure significantly easier. Moreover, it makes it possible to avoid multiple puncturing of the skin and the joint capsule and thus prevents possible damage to the intraarticular structures, which makes the procedure safer for the patient.

**Author contributions** GG—project development, data collection, manuscript editing. AŠ—project development, data collection and management, data analysis, manuscript writing and editing. HJ—project development, manuscript editing, data analysis. LG—manuscript writing, data analysis, data collection.

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### Compliance with ethical standards

**Conflict of interest** The authors declare that they have no conflict of interest.

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