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CASE REPORT

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Rare vascular variations: the ulnar artery and superficial brachioulnar artery. A case report and review of the literature

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Background*: Cardiovascular diseases are among the most common causes of death worldwide. Interventions such as percutaneous coronary intervention, used to recanalise coronary stenoses, require precise anatomical knowledge, particularly regarding vascular variations, to avoid complications.*

Materials and methods*: In our study, we describe a rare anatomical variation of the superficial brachioulnar artery (SBUA).*

Results*: We present an SBUA originating from the brachial artery in its upper third and then running superficially in a straight course to the hand, where it assumes the full function of the ulnar artery. At the same time, the regular ulnar artery terminates as a hypoplastic vessel that exclusively supplies the local musculature. This combination expands the existing literature and highlights the clinical relevance of vascular variations.*

Conclusions*: Our case report underscores the importance of precise preoperative imaging to identify vascular anomalies early while minimising patient safety-related complications. Additionally, this new variation of the SBUA emphasises the need to integrate anatomical variations more thoroughly into medical education and research. The latter would ensure the systematic capture of their prevalence and implications to improve clinical practice in the long run.* (Folia Morphol 2026; 85: e01726082)

Keywords: anatomical variation; brachial artery; clinical implications; forearm vascular anatomy; preoperative imaging; superficial brachioulnar artery; surgical complications; ulnar artery; vascular anomalies; vascular variations

INTRODUCTION

Cardiovascular diseases account for the highest mortality rates worldwide [18]. To reduce these rates, various procedures from different medical disciplines have been developed to improve patient health outcomes. Among these procedures is percutaneous coronary intervention (PCI), a therapeutic technique used to recanalise a coronary stenosis using a balloon catheter. During this procedure, a stent is often implanted to dilate and reopen a narrowed segment of a coronary artery. Prior to 1989, PCI was predominantly performed via the femoral artery (FA). In the following decades, thousands of patients were studied using a more recent approach, namely PCI via

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the radial artery (RA). This method is particularly associated with a significantly reduced perioperative risk of major bleeding (RA: 0.05%/FA: 2.3%) [8, 11]. Furthermore, the RA is frequently utilised in catheter examinations or bypass grafting surgeries, as this artery is associated with better long-term outcomes, making it an effective option for bypassing a coronary stenosis [21]. To perform these procedures, it is crucial to first assess the compensatory capacity of the ulnar artery to avoid potentially harmful hand ischemia [19, 21].

However, the ulnar artery does not always have the full capacity to supply the hand with a sufficient amount of blood. For example, the two forearm arteries may not form an anastomosis in the superficial palmar arch of the hand. Such an anastomosis is present in only 85% of cases [7], leaving 15% of cases in which the ulnar artery cannot provide the sole arterial blood supply. These factors should be examined prior to any procedure in order to ensure that existing anatomical variations are identified beforehand. Variations are relevant across all medical disciplines, as they influence the planning and execution of surgical, therapeutic, interventional, and diagnostic procedures [9, 16]. As previously described, variations in the arterial supply are of particular importance, as they are not only relatively common but can also create clinically challenging and complicated cases [3, 5, 16].

One of the less frequent variations is the superficial brachioulnar artery (SBUA), which can typically fulfil the function of the ulnar artery while running superficially, making it particularly susceptible to injury and thus clinically significant in various respects [2, 5, 6, 14, 15, 17]. Recently, Flisiński et al. [5] described a variant of the SBUA originating from the upper axillary artery and continuing as the ulnar artery into the superficial palmar arch (SPA). In our description of a similar yet slightly modified course, we further highlight the importance of documenting vascular variations such as that reported by Flisiński et al. [5].

In this study, we present a vascular variation of the SBUA (Fig. 1, 2) with the distinction that, unlike the vessel described by Flisiński et al. [5], the vessel in our case originates directly from the brachial artery, ultimately passing through the ulnar canal (Guyon's canal) (Fig. 3) and forming the SPA. Additionally, we describe a terminal segment arising from the regular ulnar artery with significant

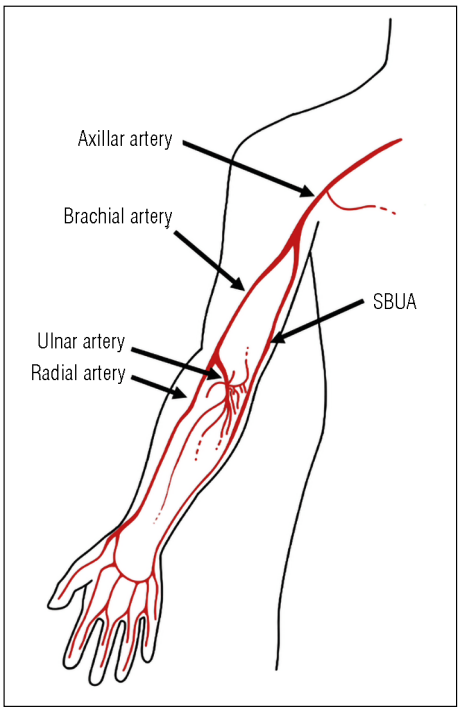

Figure 1. Schematic overview of the superficial brachioulnar artery (SBUA) and the ulnar cascular variation. Institute of Anatomy UMC Mainz — S. Peter.

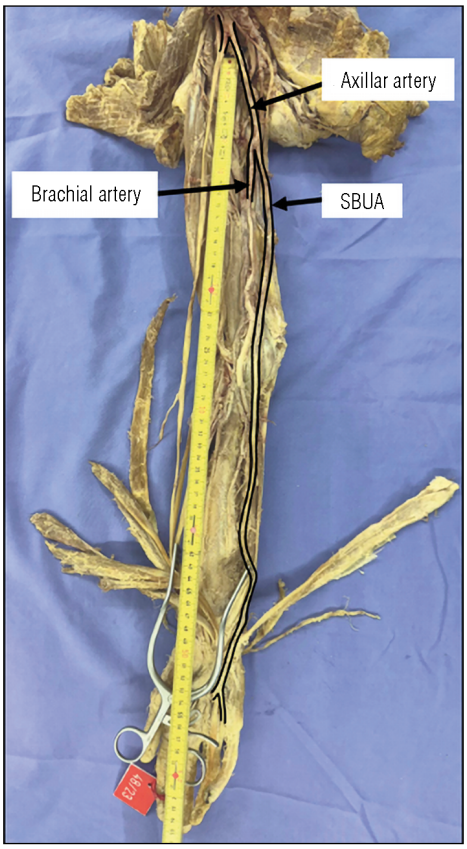

Figure 2. Superficial brachioulnar artery (SBUA) *in situ* with an overlay for better tracking. Institute of Anatomy UMC Mainz.

Figure 3. Vascular course of the brachial artery with variations of the ulnar artery. Institute of Anatomy UMC Mainz.

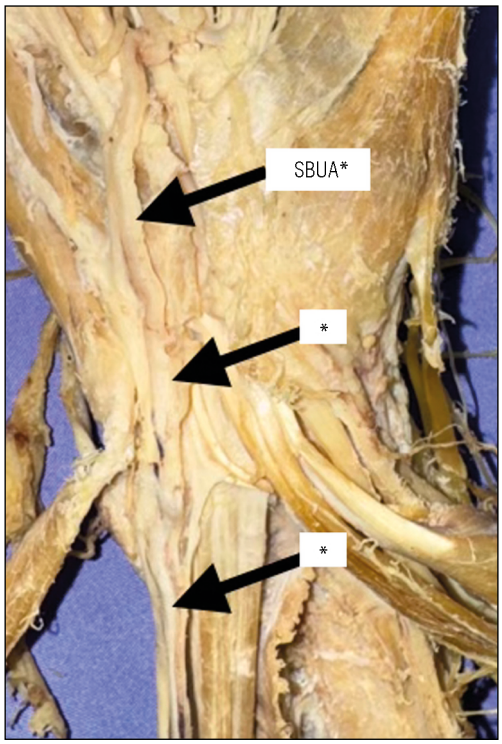

Figure 4. Superficial brachioulnar artery (SBUA) in the channel path. The arrow markst he SBUA. Institute of Anatomy UMC Mainz.

branching characteristics (Fig. 1, 4). Notably, as in both Flisiński et al.'s description [5] and ours, this branch represents one of the bifurcation vessels of the brachial artery in the cubital fossa but ends hypoplastically after a very short course.

CASE REPORT

During a dissection course for preclinical medical students in November 2024 at the University Medical Center Mainz, an unusual variation of the SBUA was discovered in the right upper extremity of a 91-year-old formalin-fixed female body donor of Caucasian descent. While dissecting the regio antebrachii, a unique variation of the ulnar artery was observed, characterised by marked branching and hypoplastic terminal strands. No vascular diseases were reported.

The SBUA originated from the upper third of the brachial artery, approximately 20.5 centimetres (cm) proximal to the brachial bifurcation and 7 cm distal to the origin of the subscapular artery. This variation can clearly be classified as a branch of the brachial artery (Fig. 1, 2).

After its origin, the vessel ran superficially to the bicipital aponeurosis on the medial side of the upper extremity, skimming the cubital fossa medially in the anatomical neutral position (palms facing ventrally, thumb pointing laterally). The artery continued towards the ulnar side of the forearm, running superficially to the distal end of the forearm, where it entered the ulnar canal (Guyon's canal) and formed the superficial palmar arch (SPA) beneath the palmar aponeurosis (Fig. 3). On its path to the hand, the SBUA crossed the flexor muscles of the forearm in a very clear and straight trajectory. At no point before entering the ulnar canal did it follow its usual course lateral to the ulnar nerve. This positioning occurred only within Guyon's canal, where the SBUA presented itself as the dominant arterial structure (Fig. 1–3).

The regular ulnar artery in this case also ended hypoplastically after a short course. Originating directly from the bifurcation of the brachial artery in the cubital fossa, the ulnar artery terminated abruptly after approximately two centimetres. However, before terminating, it gave rise to five terminal branches. In the frontal view, the branching appeared as follows (Fig. 4): a dorsal branch, a branch on the radial side, a branch on the ulnar side, and two caudal branches, one of which ended immediately in a bifurcation. The laterally positioned branch arising from this vascular division could be

identified as the common interosseous artery of the forearm, which, as known, bifurcates into the anterior and posterior interosseous arteries after approximately two centimetres. The anterior interosseous artery was traceable beneath the musculus pronator quadratus to its passage point through the interosseous membrane onto the dorsal side of the forearm.

The branch on the ulnar side showed fine distal bifurcations into six smaller branches with varying diameters between 1.5 and 3 mm. The largest of these branches entered the flexor digitorum profundus muscle and terminated in the terminal microcirculation. The smaller branches also entered the surrounding musculature and could not be traced further.

None of the immediate branches of the regular ulnar artery reached the hand or contributed to its arterial supply. Instead, this task was solely performed by the SBUA, which traversed the Guyon canal and formed the superficial palmar arch.

Morphometric data

The SBUA measured 6 millimetres (mm) in diameter at its proximal origin, decreasing to 4 mm as it passed through the ulnar canal. Its total length from origin to its entry into the superficial palmar arch was 43 cm. In comparison, the hypoplastically ending ulnar artery had a maximum diameter of 6 mm but was functionally significantly subordinate. It divided into five terminal branches, which contributed solely to the supply of the immediately surrounding musculature.

Similar morphometric data have been published by various authors [2, 3, 5, 9, 10, 14–16], describing an SBUA originating from either the axillary or brachial artery. The prevalence of the simultaneous presence of a brachial artery and an SBUA in the upper arm, along with a radial artery and an SBUA in the forearm, is reported to be 4.2% [16]. The frequency of the additional coexistence of both aforementioned arteries and an ulnar artery is less than 0.26% [16]. However, in the literature, the SBUA is often described as a duplication of the ulnar artery, functioning as a fully developed vessel, which does not align with our findings [16]. During our examination, we observed a short additional ulnar artery arising from the vascular bifurcation of the brachial artery and subsequently branching into five terminal branches.

To our knowledge, there is as yet no publication or research describing a course of the SBUA combined with both an additional short and branching ulnar artery. This further emphasises the significance of our observation. The SBUA we identified did not follow the typical course of the ulnar artery lateral to the ulnar nerve at any point until it entered the ulnar canal. Additionally, no previous reports describe a ulnar artery that bifurcates into several short terminal branches after such a brief course to supply the proximal forearm musculature with arterial blood.

Comparison with existing literature

1. **Rodríguez-Niedenführ et al. (2001) [16]:** This study classified arterial variations in the upper arm and described the SBUA with an incidence of approximately 1.9%. However, no reference was made to Guyon's canal. Our findings, along with the initial description by Flisiński et al., expand this classification with a new anatomical peculiarity.
2. **Casal et al. (2012) [2]:** This study highlighted the clinical significance of superficial arterial variants but did not provide specific details regarding the Guyon canal.
3. **Poublon et al. (2017) [13]:** The authors studied neurovascular structures in the Guyon canal and described variations of the ulnar artery. However, the observation of a dominant SBUA in the Guyon canal was not documented.
4. **Konarik et al. (2020) [9]:** In their examination of 423 extremities, Konarik et al. identified a variety of arterial variations. The SBUA presented here extends these data with a rare combination of course and functionality.
5. **Comparison with Flisiński et al. (2023) [5]:** Our SBUA differs in its origin from the brachial artery and the terminal branching of the ordinary ulnar artery. Flisiński et al. described a hypoplastic ulnar artery, which was also observed in our case, further highlighting the functional dominance of the SBUA in hand perfusion.
6. **Clarke et al. (2021) [4]:** This case report proposed a detailed and, above all, uniform classification system for arterial vascular variants of the upper extremity based on origin, course, and endpoint. This classification is scientifically sound, as it is the only way to achieve a uniform consensus on nomenclature. Our described variation originates in the upper third of the brachial artery and continues into the superficial palmar arch. Since a regular ulnar artery, in addition to our SBUA, is present in our case, the classification system proposed by Clarke et al. is not applicable.

Therefore, we name our case in accordance with its site of origin and usual function. The presence of a hypoplastic regular ulnar artery with no contribution to hand blood flow further supports the dominant functional role of the SBUA in this case.

Clinical significance

1. **Surgical implications:** The superficial course of the SBUA poses an increased risk of injury, particularly during procedures on the forearm and hand. The additional presence of the SBUA in the Guyon canal may also elevate the risk of compression syndromes, potentially affecting accompanying veins and nerve structures [10, 13].
2. **Diagnostic challenges:** The reduced size of the SBUA compared to the regular ulnar artery (1.2 mm vs 2 mm) could cause perfusion issues during catheterisations, such as angiography. Preoperative Doppler ultrasound examination is essential to identify this variant and avoid misinterpretation during imaging procedures [2, 19].
3. **Research needs:** The exact incidence of such variations remains unclear. Further systematic studies are necessary to quantify the prevalence, clinical significance, and potential impact on surgical and diagnostic procedures.
4. **Blood sampling:** The presence of a superficially positioned artery carries significant implications for clinical practice. During routine venous blood sampling or administering medications intravenously, such vessels are at risk of inadvertent puncture due to superficial location, which may lead to complications including arterial injury or arterial injection [6].

Embryological perspective

The SBUA might originate from a persistent superficial brachial artery that failed to regress completely during embryonic development [16]. Its dominance and the presence of accompanying veins in the Guyon canal suggest an embryological adaptation affecting both arterial and venous structures [5].

RESULTS AND DISCUSSION

In the case report discussed here, a previously undocumented variant of a SBUA is presented. This variant is of considerable anatomical and clinical significance because of its superficial course and location within Guyon's canal. Additionally, there is atypical terminal branching of the regular ulnar artery, which, in our case, does not constitute the primary blood supply to the hand. The functional dominance of the SBUA presented here represents a novel deviation from known arterial patterns and expands the current classification of superficial arterial variations.

In the following section, our findings are discussed in the context of the current literature and state of research. The aim is to highlight the differences and similarities compared with existing descriptions of such vascular variations. Moreover, elucidating the clinical significance of this anatomical peculiarity with regard to surgical procedures, diagnostic approaches, and potential complications is another central concern. The results of this case report underscore the need for further clinical and anatomical research on the prevalence and relevance of such vascular variations. Based on the postulations of Wysiadecki et al. [20], this report contains a systematic morphological description, morphometric data, clinical-anatomical interpretation, and image documentation. Therefore, the study fulfills important criteria for standardised reporting of anatomical variations. Uniform protocols will help improve the comparability and reproducibility of future anatomical studies.

CONCLUSIONS

The variation of the SBUA examined here represents a clinically significant anatomical anomaly whose incidence and prevalence need to be reassessed in larger studies.

This case expands the existing literature with a new description of previously undocumented features in the course of both arteries and provides new insights into the variability of the arterial supply of the forearm and hand. The discovery of a hypoplastic ulnar artery, whose function in supplying the hand is entirely assumed by the SBUA, underscores the necessity of precise preoperative or pre-interventional imaging. This is essential for ensuring patient safety and avoiding peri-interventional complications [2, 5, 6, 14, 15, 17, 19, 21]. The combination of arteries described here requires special attention, as it could lead to unrecognised perfusion difficulties during various interventional procedures.

An equally important point derived from case reports such as this one is the need for increased focus on anatomical variations in medical education. Variations such as the SBUA can lead to unrecognised errors and serious complications in everyday clinical

practice. Since such anatomical variations are very common among patients [16], they should be incorporated into the curricula of clinical medical education and specialist training in various disciplines to better prepare future physicians for potential complications [1, 12]. This would increase patient safety during interventions and help prevent possible complications.

To address the growing complexity and diversity of anatomical structures, we believe that medical education should specifically encourage engagement with rare cardiovascular variations. For instance, the introduction of interactive teaching methods such as high-resolution imaging, practical workshops, and the use of 3D models could be beneficial. Gaining deeper knowledge and a better understanding of these variations would not only contribute to more accurate diagnoses but also minimise the risk of iatrogenic injuries and improve patient outcomes.

Ultimately, it remains necessary to continue research into the prevalence of anatomical variations such as the SBUA. Long-term studies and larger databases are required to determine the incidence of these variations more accurately and to fully understand their implications for surgical procedures and other interventions.

ARTICLE INFORMATION AND DECLARATIONS

Data availability statement

This case report is based on a single anatomical observation made during a regular dissection course as part of the medical curriculum. No additional datasets were collected or analyzed. The information presented is limited to the observations and figures described in the manuscript. For reasons of data protection and donor anonymity, no further raw data or supplementary information can be provided. Specific inquiries regarding the methodology or observations can be directed to the corresponding author. References, sources, and citations are included in the relevant section of the article.

Ethics statement

No formal ethics approval was sought for this case report. The anatomical variation of the arteria ulnaris is described here was identified incidentally during a routine dissection course in the medical curriculum. This is a retrospective observation without additional interventions or examinations. The anonymity of the body donor is fully preserved, and no identifying features or personal data are used. This type of report does not fall under the criteria for ethical approval, as no prospective study was conducted and no patient data were involved. The publication is in compliance with the guidelines of our institution regarding observations made during dissection courses.
All observations reported herein comply with the ethical principles of the Declaration of Helsinki in its current version.

Author contributions

Conception: FP, FL, MJS, TW. Study design: FP, MJS, JM. Writing — original draft: FP, TS, FL, SP, JM, SLS, TW. Photographic imaging and figures: SP, FP. Dissection: FP, FL, TS, SP, SLS, TW, JM, MJS.

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Conflict of interest

The authors declare no conflicts of interest.

Supplementary material

None.

REFERENCES

1. Alraddadi A. Literature review of anatomical variations: clinical significance, identification approach, and teaching strategies. Cureus. 2021; 13(4): e14451, doi: 10.7759/cureus.14451, indexed in Pubmed: 33996311.
2. Casal D, Pais D, Toscano T, et al. A rare variant of the ulnar artery with important clinical implications: a case report. BMC Res Notes. 2012; 5: 660, doi: 10.1186/1756-0500-5-660, indexed in Pubmed: 23194303.
3. Claassen H, Schmitt O, Werner D, et al. Superficial arm arteries revisited: brother and sister with absent radial pulse. Ann Anat. 2010; 192(3): 151–155, doi: 10.1016/j.aanat.2010.02.005, indexed in Pubmed: 20417079.
4. Clarke E, Mazurek A, Radek M, et al. Superficial brachial artery — a case report with commentaries on

the classification. Transl Res Anat. 2021; 23: 100112, doi: 10.1016/j.tria.2021.100112.
5. Flisiński P, Badura M, Szpinda M. Superficial brachioulnar artery in man. Folia Morphol. 2023; 82(4): 936–942, doi: 10.5603/fm.97261, indexed in Pubmed: 37822068.
6. HAZLETT JW. The superficial ulnar artery with reference to accidental intra-arterial injection. Can Med Assoc J. 1949; 61(3): 289–293, indexed in Pubmed: 18148099.
7. Jelicic N, Gajisin S, Zbrodowski A. Arcus palmaris superficialis. Acta Anat. 1988; 132(3): 187–190, indexed in Pubmed: 3414366.
8. Jolly SS, Amlani S, Hamon M, et al. Radial versus femoral access for coronary angiography or intervention and the impact on major bleeding and ischemic events: a systematic review and meta-analysis of randomized trials. Am Heart J. 2009; 157(1): 132–140, doi: 10.1016/j.ahj.2008.08.023, indexed in Pubmed: 19081409.
9. Konarik M, Musil V, Baca V, et al. Upper limb principal arteries variations: a cadaveric study with terminological implication. Bosn J Basic Med Sci. 2020; 20(4): 502–513, doi: 10.17305/bjbms.2020.4643, indexed in Pubmed: 32343941.
10. Halliday N, Rayan G, Zardi L, et al. Distribution of ED-A and ED-B containing fibronectin isoforms in dupuytren's disease. J Hand Surg Am. 1994; 19(3): 428–434, doi: 10.1016/0363-5023(94)90057-4.
11. Marbach JA, Alhassani S, Wells G, et al. Radial access first for PCI in acute coronary syndrome: are we propping up a straw man? Herz. 2020; 45(6): 548–556, doi: 10.1007/s00059-020-04958-4, indexed in Pubmed: 32548776.
12. Nzenwa IC, Iqbal HA, Bazira PJ. Exploring the inclusion of anatomical variation in medical education. Anat Sci Educ. 2023; 16(3): 531–546, doi: 10.1002/ase.2254, indexed in Pubmed: 36637969.
13. Zhang D, Earp B, Blazar P. Rates of complications and secondary surgeries after in situ cubital tunnel release compared with ulnar nerve transposition: a retrospective review. J Hand Surg Am. 2017; 42(4): 294.e1–294.e5, doi: 10.1016/j.jhsa.2017.01.020.
14. Senanayake KJ, Salgado S, Rathnayake MJ, et al. A rare variant of the superficial ulnar artery, and its clinical implications: a case report. J Med Case Rep. 2007; 1: 128, doi: 10.1186/1752-1947-1-128, indexed in Pubmed: 17988391.
15. Junior ES, Batista R, Oliveira M, et al. Pseudoaneurisma de carótida comum secundário a trauma contuso: opção de tratamento por cirurgia a céu aberto. Jornal Vascular Brasileiro. 2011; 10(3): 261–265, doi: 10.1590/s1677-54492011000300014.
16. Rodríguez-Niedenführ M, Vázquez T, Nearn L, et al. Variations of the arterial pattern in the upper limb revisited: a morphological and statistical study, with a review of the literature. J Anat. 2001; 199(Pt 5): 547–566, doi: 10.1046/j.1469-7580.2001.19950547.x, indexed in Pubmed: 11760886.
17. Senanayake KJ, Salgado S, Rathnayake MJ, et al. A rare variant of the superficial ulnar artery, and its clinical implications: a case report. J Med Case Rep. 2007; 1: 128, doi: 10.1186/1752-1947-1-128, indexed in Pubmed: 17988391.
18. Vaduganathan M, Mensah GA, Turco JV, et al. The global burden of cardiovascular diseases and risk: a compass for future health. J Am Coll Cardiol. 2022; 80(25): 2361–2371, doi: 10.1016/j.jacc.2022.11.005, indexed in Pubmed: 36368511.
19. Wilkins RG. Radial artery cannulation and ischaemic damage: a review. Anaesthesia. 1985; 40(9): 896–899, doi: 10.1111/j.1365-2044.1985.tb11055.x, indexed in Pubmed: 3901815.
20. Wysiadecki G, Varga I, Klejbor I, et al. Reporting anatomical variations: Should unified standards and protocol (checklist) for anatomical studies and case reports be established? Transl Res Anat. 2024; 35: 100284, doi: 10.1016/j.tria.2024.100284.
21. Zheng D, Zhang Li, Yang MD, et al. Use of radial artery grafts for coronary artery bypass grafting. Heart Surg Forum. 2022; 25(3): E385–E390, doi: 10.1532/hsf.4697, indexed in Pubmed: 35787753.