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Post-Traumatic Pseudoaneurysm of Common Digital Artery of Superficial Palmar Arch- A Curious Case with Critical Complexities

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Abstract

Pseudoaneurysm is an extremely rare condition but poses significant challenges in early diagnosis and can lead to devastating complications if untreated. Pseudoaneurysm is defined as the dilation of the arterial wall caused by disruption of the vessel wall leading to extravasation of blood into a false sac that has communication with the vessel lumen. True aneurysm is formed by all three layers of the arterial wall while pseudoaneurysm is formed by tunica adventitia. Trauma is the most common cause of pseudoaneurysms. It is a rare entity but with significant complications such as thrombosis, embolism and compression of nerves and veins. Here we bring up a case of a twenty-one-year-old male who presented with swelling over his left hand below 2nd web space following a fire crack injury which was associated with pain, restriction of movement and numbness over his left middle finger. The swelling was found to be well-defined, pulsatile, compressible, and cystic in consistency with palpable thrill and systolic bruit on auscultation. Doppler ultrasound showed a cystic lesion with characteristic yin-yang flow. A diagnosis of possible partially thrombosed post-traumatic pseudoaneurysm was made. Surgical ligation with excision under regional anaesthesia was done. Histopathological examination confirmed the diagnosis of pseudoaneurysm. The patient made a full recovery with no post-operative complications. This emphasizes the importance of early diagnosis and management of pseudoaneurysm. Also, this reinvigorates surgical management as the gold standard treatment.

Keywords: *Pseudoaneurysm, Superficial Palmar Arch, Surgical ligation and excision, Ultrasonography.*

Introduction

The incidence of pseudoaneurysm is rare, and false aneurysm of the superficial palmar arch is extremely unusual [1]. The foremost case of pseudoaneurysm was reported by Paul Thiebauld. Since then, only a handful of cases of pseudoaneurysm of the superficial palmar arch have been reported in the literature [1, 2]. Pseudoaneurysm is defined as the dilatation of the arterial wall usually followed by trauma over the site, leakage of blood at the site of injury and collection of blood contained by the surrounding tissue. It is differentiated from a true aneurysm in that the pseudoaneurysm doesn't contain all three layers of the vessel wall [1]. It is usually a saccular aneurysm. Trauma is the most common cause for pseudoaneurysm which could be in the form of penetrating injury, repeated microtrauma or iatrogenic procedures such as arterial catheterization. The characteristic triad of pseudoaneurysm is palpable, painful, and pulsatile swelling. Ultrasound remains an important investigation for diagnosing pseudoaneurysm with a specificity of 94% and a characteristic yin-yang flow [3, 4]. The complications of pseudoaneurysm could be rupture, thrombosis and embolism, haemorrhage, and compression of nerves.

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Surgical resection with ligation or arterial reconstruction remains the gold standard management [5, 6]. Also, there is the emergence of many novel, endovascular treatment options such as coil embolization, angioplasty, ultrasound ultrasound-guided thrombin injection which needs further exploration. Other minimally invasive options can be considered in case of early presentations with or without symptomatology with stringent follow-up. The fact remains that pseudoaneurysm is an extremely rare vascular condition with significant, devastating complications. As such, it is essential to study, explore and report every case of pseudoaneurysm to better understand this curious rare entity, so that it would become easy for early identification of pseudoaneurysm among various other differentials and choosing the most effective management strategy to prevent the occurrence of any crippling complications such as ischemia and gangrene. Therefore, here we describe a presentation of pseudoaneurysm of the superficial palmar arch in a twenty-one-year-old male following a firecracker injury who was operated on in our department. The case presentation is accompanied by details of operative findings, histological findings, and post-operative and functional outcomes. Approval from the Institutional Ethics Committee, Sree Balaji Medical College and Hospital was waived. Informed consent was obtained from the patient stating that data related to his case would be submitted for publication.

Methodology

A twenty-one-year-old male student hailing from the southern part of India presented to the surgical outpatient department with complaints of swelling over the left palm for the past 3 months. The patient had sustained a firecracker injury 3 months back following which he developed a swelling in the left palm below the 2nd web space. The swelling was progressive to attain the present size. The swelling was associated with pain which was aggravated by flexion of the middle finger for the past 1 month. The patient reported restriction of movement and numbness over the left middle finger over the past twenty days.

The patient didn't have any significant comorbidities and had no history of any substance use. On examination, a solitary, ovoid, pulsatile swelling of size 2.5cm X1.7cm with a well-defined margin was present between the 2nd and 3rd metacarpal bone. (Figure 1,2). The overlying skin was stretched and scary present. On palpating the swelling, it was a compressible swelling, had a cystic consistency, mild tenderness present, expansile pulsation and thrill was observed. Allens test was performed which showed adequate patency of radial and ulnar artery. Transillumination was negative. Bruit was heard over it on auscultating.

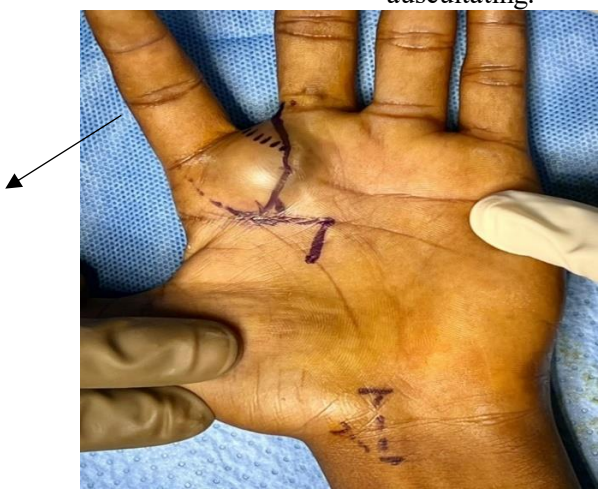

Figure 1: Swelling Marked in the Left Hand

Figure 2: Pre-op Image

His baseline blood investigations turned out to be within normal limits. Ultrasonographic findings of the swelling showed a well-defined cystic lesion measuring approximately 1.8 x 1.9 x 1.8 cm with characteristic YIN YANG flow on colour doppler noted in the palmer aspect of left hand between index and middle finger with crescentic echogenic thrombus within the lesion probably post-traumatic pseudo aneurysm to be considered (Figure 3). MRI of the left hand showed a well-defined thick-walled loculated cystic lesion measuring ~ 1.9 x 2.1 x 1.8 cm (CC X TR X AP) noted in the palmar surface of the second web-space superficial to flexor tendon of the 2nd and 3rd fingers. The lesion is seen to have thick-walled septations. Adjacent soft-tissue tendons and muscles appear normal. The overlying skin appears normal. Lesion seems to be supplied by one of the common palmar digital arteries adjacent to the index finger arising from the radial artery (Figures 4 and 5). The patient was planned for surgical ligation and excision with or without a venous graft. (Figure 6).

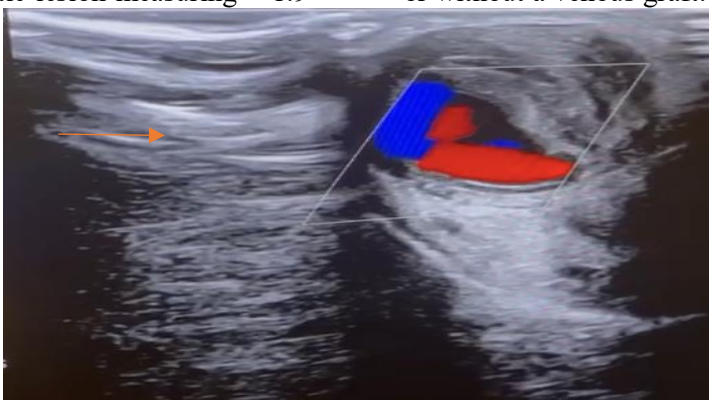

Figure 3: Doppler Ultrasonography of the Swelling

Figure 4: T1 Weighted MRI Image of Left Hand (Coronal Section)

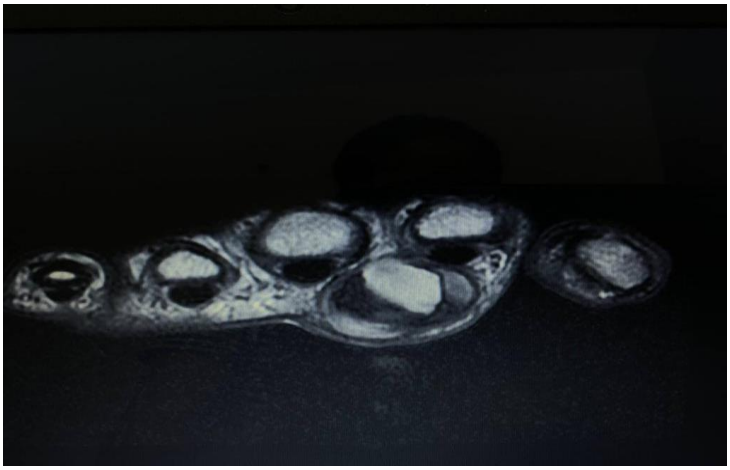

Figure 5: T1 Weighted MRI Image of Left Hand (Axial Section)

Figure 6: Pre-Operative Venous Graft Marking

Surgery was performed under regional anaesthesia. A tourniquet was applied over the left arm and an extended Z-plasty incision was made over the swelling using a number 15 scalpel blade. Full thick triangular flaps and the surrounding skin were undermined, creating 2 triangular flaps of equal size and shape. Adequate undermining of surrounding subcutaneous tissue was performed to visualize the swelling. After meticulous dissection, a pseudoaneurysm was identified at the level of the bifurcation of a common palmar digital artery supplying the index and the middle finger. A tourniquet was released and the artery proximally to the pseudoaneurysm was clamped with the help of a bulldog vascular clamp. Peripheral vascularity was assessed by capillary refill time which was found to be adequate. Following this, ligation and excision of pseudoaneurysm were done (Figures 7 and 8). No anticoagulant was administered during or after the surgery. The excised material was sent for histopathological examination. Hemostasis was achieved and the skin was closed using interrupted sutures. Corner stitches were used for flap tips.

Figure 7: Intraoperative Image of the Pseudoaneurysm

Figure 8: Intraoperative Image Post-Excision

Histopathological examination showed a large, dilated blood vessel filled with blood clots and an area of thrombotic changes adherent to the fibro collagenous wall. The outer layer showed sparse mononuclear cells and vascular proliferation. The endothelial layer is not appreciable. (Figures 9 and 10) This supported the diagnosis of pseudoaneurysm. Following this, the patient was discharged with supportive medications.

Results

The patient recovered completely with no post-operative complications. The post-operative Allens test was performed which showed adequate peripheral circulatory perfusion. The patient was followed up for 6month period. There were no complaints reported by the patient. Clinical examination throughout the follow-up period showed no recurrent swelling, no thrill or bruit heard, and no features suggestive of vascular impairment. There was an improvement in the aspect of the full range of movement of the left middle finger. The numbness over the left middle finger resolved completely. The patient was satisfied with the outcome of the surgical procedure (Figure 11).

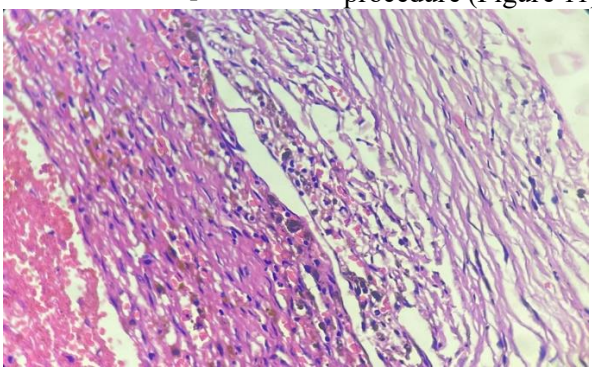

Figure 9: Histopathological Image Under (10X)

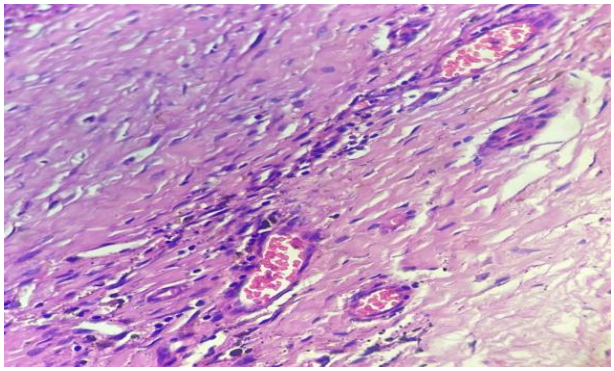

Figure 10: Histopathological Image Under (40X)

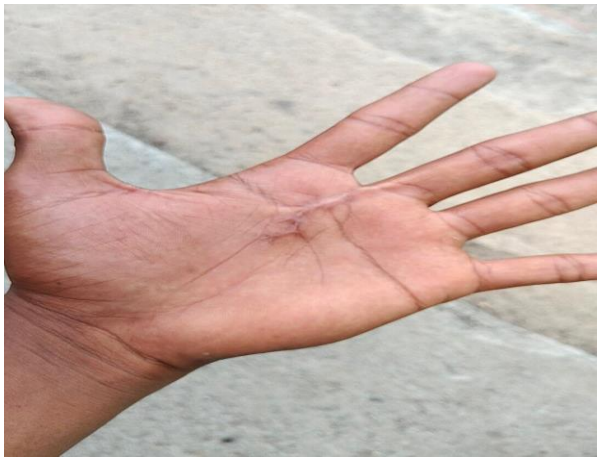

Figure 11: Follow-up Image After 6 Months

Discussion

Pseudoaneurysm occurring in the common palmar digital artery of the superficial palmar arch is an extremely rare condition with only a handful of cases reported [7]. This case report throws light on this very rare and intriguing phenomenon.

The aneurysm is defined as a more than 50% increase from the normal arterial diameter. Aneurysm is of two types namely, true aneurysm and pseudo or false aneurysm. True aneurysm is the dilatation of all 3 layers of the arterial wall. Whereas pseudoaneurysm occurs because of disruption of the vessel wall causing extravasation of blood into a false sac that has communication with the vessel lumen. The inner lining of the pseudo sac is formed by tunica adventitia, and it's eventually replaced by fibrous scar tissue. This forms the pseudoaneurysm and it's usually a saccular aneurysm [8, 9].

The various etiological factors for pseudoaneurysm could be traumatic, infectious, or degenerative. Of these, traumatic injury is the commonest cause of pseudoaneurysm, which could be due to a penetrating wound, gunshot, or firearm wound, fracture wound, or puncture wound as seen in drug abuse and iatrogenic arterial injury like cardiac catheterization [10, 11, 12].

The characteristic triad of pseudoaneurysm as already mentioned is a palpable, painful, and pulsatile swelling. The swelling grows initially along the course of the artery. It is well-circumscribed, isolated, compressible, exhibiting expanding pulsations and moves sideways but not along the course of the artery. The pulsation may disappear when the artery is completely compressed. The formation of a thrombus or an embolus may make the pulsatile beat difficult to feel. The thrill may be palpable and on auscultation, a systolic bruit may be heard. Thinning of the skin, reddish discolouration and ulcerations act as signs of imminent rupture [13, 14, 15].

The effects of an aneurysm are oedema due to pressure on veins and over the skin, altered sensation such as numbness and paraesthesia due to compression of nerves. The other significant complications include thrombosis and emboli formation which may lead to digital gangrene and ischemia. There could also be infection and rupture of the pseudoaneurysm.

The various differential diagnoses that should be considered in this case are abscess, hematoma, lipoma, AV fistula and vascular tumours. The pulsatile nature of the swelling, presence of thrill and systolic bruit are some distinguishing features of pseudoaneurysm compared to other differentials [16].

Doppler ultrasonography is the initial imaging to be done as it has a specificity of 97% and a sensitivity of 94%. The three features seen in ultrasound imaging are a neck connecting the pseudoaneurysm, a characteristic Yin-Yang flow and a to-and-fro flow. The Yin-Yang flow

represents a bidirectional swirling blood flow within the cavity of the aneurysm. The to and fro flow corresponds to the diastole during which the pressure gradient change leads to reversal of flow. MRI helps to complement ultrasound in identifying normal anatomy and its variants and for planning surgical procedures. Angiography possibly provides vital information regarding the localization of the aneurysm and the presence of collateral branches, but the possibility of distal embolization limits its use. MRI and ultrasonography are not associated with these complications and hence are adequate in planning surgical management [10, 13, 16].

Surgical treatment of resection with ligation or arterial reconstruction is the mainstay of treatment. Performing the Allens test before surgery is important. In case of the hand being adequately perfused, simple ligation and resection without revascularization is possible. However surgical treatment with revascularization is considered to be the approach with a high success rate and minimal morbidity [17, 18].

Some alternative non-surgical treatments are being studied such as endovascular procedures like coil embolization, angioplasty, ultrasound ultrasound-guided thrombin injection. However, the efficacy of these procedures is under debate. Surgical treatment remains the gold standard treatment [19, 20].

While studying the existing literature, Papatheodorou et al presented a case about post-traumatic pseudoaneurysm of the palmar arch, in which they performed an open surgical reconstruction with the interposition of autologous vein graft for the first time in literature [10]. In another study done by Lucchina et al., a non-autologous bypass option was used [21]. Whereas in our study, though there was a pre-operative plan for venous graft, intraoperatively, we found that capillary refill time was adequate with clamping of the arterial segment proximal to the swelling. Therefore, it was decided that excision with ligation was sufficient in this case without venous graft, as it would reduce the duration in which the patient is under anaesthesia and lessen the post-anaesthetic complications. A study done by Schoretsanitis N et al., described the modality of treatment of excision with ligation, like the current study [1]. Ferreri et al. brought up a case of pseudoaneurysm in a patient with haemophilia in whom ultrasound-guided thrombin injection was performed to avoid the complication of haemorrhage during surgical resections [22]. Similarly, Bosman et al. proceeded with ultrasound-guided thrombin injection as a management strategy as the size of the pseudoaneurysm was small. Gull et al. described a procedure of endovascular coil embolization for the pseudoaneurysm [5]. Various studies by Fields et al., and Cromheecke et al., outline conservative compression bandages as management for smaller uncomplicated pseudoaneurysms [2, 23]. In our case, since the patient had gradually increased the size of the swelling with severe throbbing pain and he already developed a complication of pseudoaneurysm which is partially thrombosed, we opted for surgical excision with ligation.

The authors would like to acknowledge the limitations of the study. As this is a single case report, generalisation of the findings of this study to various cases of pseudoaneurysm is difficult. Furthermore, the single case did not provide an opportunity to study the other surgical and upcoming non-surgical methods. So, the efficacy of these methods compared to surgical resection couldn't be commented upon.

Conclusion

This case report provides an opportunity for a clinical lens into the curious entity of pseudoaneurysm. Considering the extremely rare nature yet the significant complications caused by pseudoaneurysm, it is highly relevant and imperative to analyse the nature and outcome of each of such cases. Pseudoaneurysm should be taken into account

as a differential diagnosis, especially for swelling following an arterial injury. Doppler ultrasonography is immensely helpful for identification. Early identification and intervention are necessary to avoid the various devastating complications. Though surgical management is widely studied and acknowledged, other endovascular procedures like coil embolization, angioplasty, and ultrasound-guided thrombin injection are gaining traction and there is a need for further research in this regard. But conclusively, surgical management is considered the superior option in the current scenario.

Conflict of Interest

None.

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References

[1]. Schoretsanitis, N., Moustafa, E., Beropoulis, E., Argyriou, C., Georgiadis, G. S., Georgakarakos, E, 2015, Traumatic Pseudoaneurysm of the Superficial Palmar Arch: A Case Report and Review of the Literature. *J Hand Microsurg.* Jun;7(1):230-2. https://doi.org/10.1007/12593-015-0183-5

[2]. Fields, J. M., Chandra, S., Au, A. K., Rotte, M., Ku, B. S., 2013, Images in emergency medicine. Child with painful palmar mass. Superficial palmar arch pseudoaneurysm. *Ann Emerg Med*.;62(6):569-577. https://doi.org/10.1016/j.annemergmed.2013.05.007

[3]. Maertens, A., Tchoungui Ritz, F. J., Poumellec, M. A., Camuzard, O., Balaguer, T., 2020, Posttraumatic pseudoaneurysm of a superficial branch of the ulnar artery: A case report. *Int J Surg Case Rep.* 75:317-321. https://doi.org/10.1016/j.ijscr.2020.09.029

[4]. Dell'Orfano, M., Milella, F. M., Braidotti, P., 2023, Radial artery pseudoaneurysm following wrist trauma. A case report of a rare condition. *Trauma Case Rep* 6; 44:100783. https://doi.org/10.1016/j.tcr.2023.100783

[5]. Gull, S., Spence, R. A., Loan, W., 2011, Superficial palmar arch aneurysm after carpal tunnel decompression, a rare complication: a case report. *Case Rep Med*. 2011:595120. https://doi.org/10.1155/2011/595120

[6]. Zitsman, J. L., 1998, Pseudoaneurysm after penetrating trauma in children and adolescents. *J Pediatr Surg*.;33(10):1574-1577. https://doi.org/10.1016/s0022-3468(98)90504-8

[7]. Sakamoto, A., Arai, K., 2009, False aneurysm of the superficial palmar arch in a child: A case report. *Cases J.* 2009 Jul 24; 2:7985. https://doi.org/10.4076%2F1757-1626-2-7985

[8]. Kwiecien, G. J., Garbuzov, A., Boonipat, T., Houdek, M. T., Moran, S. L., 2022, Pseudoaneurysm of the Superficial Palmar Arch in a 6-month-old Child: A Case Report. *Plast Reconstr Surg Glob Open;*10(2): e4093. https://doi.org/10.1097%2FGOX.0000000000004093

[9]. Corvino, A., Catalano, O., de Magistris, G., Corvino, F., Giurazza, F., Raffaella, N., Vallone, G., 2020, Usefulness of doppler techniques in the diagnosis of peripheral iatrogenic pseudoaneurysms secondary to minimally invasive interventional and surgical procedures: Imaging findings and diagnostic performance study. *J Ultrasound,* 23(4):563-573. https://doi.org/10.1007/s40477-020-00475-6

[10]. Papatheodorou, N., Dimitriadis, K., Doukas, D., Argyriou, C., Georgiadis, G. S., 2022, Surgical Reconstruction of Traumatic Pseudoaneurysm of Palmar Arch Caused by

Blunt Trauma. *Vasc Specialist Int* 13; 38: 30. https://doi.org/10.5758/vsi.220031
[11]. Yadav, R., Sharma, A., Pathak, S., 2023, Successful Surgical Management of Post-traumatic Superficial Femoral Artery Pseudoaneurysm with Delayed Presentation. *Cureus.* 15(9):e45739. https://doi.org/10.7759/cureus.45739
[12]. Mahmoud, M. Z., Al-Saadi, M., Abuderman, A., et al, 2015, "To-and-fro" waveform in the diagnosis of arterial pseudoaneurysms. *World Journal of Radiology*.7(5):89-99. https://doi.org/10.4329/wjr.v7.i5.89
[13]. Igari, K., Kudo, T., Toyofuku., T, Jibiki, M., Inoue, Y., 2013, Surgical treatment of aneurysms in the upper limbs. *Ann Vasc Dis*;6(3):637-41. https://doi.org/10.3400/avd.cr.13-00024
[14]. Woodley-Cook, J., Konieczny, M., Simons, M., 2015, The ulnar artery pseudoaneurysm. *BMJ Case Rep.* 2015 Oct 6;2015: https://doi.org/10.1136/bcr-2015-212791
[15]. Cozzi, D. A., Morini, F., Casati, A., Pacilli, M., Salvini, V., Cozzi, F., 2013, Radial artery pseudoaneurysm successfully treated by compression bandage. *Arch Dis Child*.;88(2):165-166. https://doi.org/10.1136/adc.88.2.165
[16]. Muir, H., Cowan, K., Steele, P., Downie, J. J., 2021, Presentation and surgical management of a superficial temporal artery pseudoaneurysm: A case report. *Int J Surg Case Rep*. 79:368-370. https://doi.org/10.1016/j.ijscr.2021.01.072
[17]. Wang, Y., Zheng, H., Yao, W., Ju, S., Bai, Y., Wang, C., Zhou, C., Liu, J., Yang, C., Huang, S., Li, T., Chen, Y., Xiong, B., 2022, Management of traumatic peripheral artery pseudoaneurysm: A 10-year experience at a single center. *J Interv Med*;6(1):29-34. https://doi.org/10.1016/j.jimed.2022.10.002
[18]. Shreve, L., Jarmakani, M., Javan, H., Babin, I., Nelson, K., Katrivesis, J., Lekawa, M., Kuncir, E., Fernando, D., Abi-Jaoudeh, N., 2020, Endovascular management of traumatic pseudoaneurysms. *CVIR Endovasc*;3(1):88. https://doi.org/10.1186/s42155-020-00182-7
[19]. Saydam, O., Serefli, D., Engin, A. Y., Atay, M., 2020, Ultrasound-guided thrombin injection for treatment of iatrogenic femoral artery pseudoaneurysms compared with open surgery: First experiences from a single institution. *Ann Surg Treat Res*. 98(5):270-276. https://doi.org/10.4174/astr.2020.98.5.270
[20]. Hughes, C. D., Binette, C., Babigian, A., 2012, Pseudoaneurysm in the hand of a three-year-old boy: A case report. *J Emerg Med*. 42(4):e87-e89. https://doi.org/10.1016/j.jemermed.2010.11.049
[21]. Lucchina, S., Nistor, A., Stricker, H., Fusetti, C., 2011, False aneurysm of the common digital artery. Is reconstruction with an arterial graft worth the efforts? A case report. *Microsurgery*.;31(3):246-250. http://doi.org/10.1002/micr.20872
[22]. Ferreira, V., Matos, A., Rego, D., et al., 2017, Percutaneous Treatment Pseudo-Aneurism of the Hand in Hemophilic Patient. *Rev Port Cir Cardiotorac Vasc*.;24(3-4):178.
[23]. Cromheecke, M., van Straalen, A. M., Damen, A., 1997, Traumatic aneurysm of a common digital artery. *J Hand Surg Br*.;22(3):416-418. http://doi:10.1016/s0266-7681(97)80417-2