Brazilian Journal of TRANSPLANTATION

https://doi.org/10.53855/bjt.v26i1.525_ENG

CASE REPORT

Pyogenic Granuloma in Kidney Transplant Recipient

Thiago Augusto Teixeira César[1,*], Sami de Andrade Cordeiro Gadelha[2], Priscilla Nogueira Gomes Hissa[3], Sonia Leite da Silva[3], Paula Frassinetti Castelo Branco Camurça Fernandes[3], Cláudia Maria Costa de Oliveira[3]

1. Universidade Federal do Ceará – Hospital Universitário Walter Cantídio – Residência Médica em Nefrologia – Fortaleza (CE), Brazil. 2. Universidade Federal do Ceará – Hospital Universitário Walter Cantídio – Residência Médica em Patologia – Fortaleza (CE), Brazil. 3. Universidade Federal do Ceará – Hospital Universitário Walter Cantídio – Departamento Sistema Urinário – Unidade de Transplante Renal – Fortaleza (CE), Brazil.

*Corresponding author: thiago86pi@gmail.com

Section Editor: Ilka de Fátima Santana F Boin

Received: June 27, 2023 | Approved: Nov. 07, 2023.

How to cite: César TAT, Gadelha SAC, Hissa PNG, Silva SL, Fernandes PFCBC Oliveira CMC. Pyogenic Granuloma in Kidney Transplant Recipient. BJT. 2023. 26 (01):e3723. https://doi.org/10.53855/bjt.v26i1.525_ENG

ABSTRACT

Objectives: This manuscript describes a clinical case of pyogenic granuloma with atypical presentation and evolution, and outlines a brief bibliographic review on the nosological entity. **Introduction:** Pyogenic granuloma is a common benign skin lesion, usually small, with some more common locations and predominance in females in adulthood. It has a correlation with trauma and medications. Its pathophysiology is in the initial stages of understanding. The typical histopathological alteration is a lobular arrangement of capillaries at the base of the dermis. Treatment is surgical, with a low recurrence rate; there are non-surgical alternatives. **Case report:** We report a case of a 25-years-old renal transplant patient who develops a giant Pyogenic granuloma in the right forearm after a mild trauma, 2 years after transplantation from a deceased donor. He performs successive surgical excisions, with several recurrences, which disappeared only after discontinuation of tacrolimus and radiotherapy it was performed successive. The peculiarities of this case are: post-kidney transplant status, large size, recurrences after surgery and radiotherapy. **Conclusions**: A patient with pyogenic granuloma, with atypical evolution, had a favorable outcome after identification and removal of a causative factor and alternative therapy. However, this report has limited potential for generalization. There are few publications of case series involving unusual situations, in addition do the involvement of the oral mucosa, paraungual/subungual regions and cases in pregnant women. Radiotherapy is a poorly performed intervention, which can be of value in refractory cases. Further studies are needed to achieve a greater understanding of this pathology and to describe treatment alternative, as well as confirming the importance of discontinuation of tacrolimus in the clinical response.

Descriptors: Pyogenic granuloma. Kidney transplantation. Tacrolimus. Ambulatory Surgical Procedures. Brachytherapy.

Granuloma Piogênico em Receptor de Transplante Renal

RESUMO

Objetivos: Este trabalho descreve um caso clínico de granuloma piogênico com apresentação e evolução atípicas, e traça uma breve revisão bibliográfica sobre a entidade nosológica. **Introdução:** O granuloma piogênico é uma lesão cutânea benigna comum, geralmente pequena, com algumas localizações mais comuns e predomínio no sexo feminino na idade adulta. Tem correlação com trauma e medicamentos. Sua fisiopatologia está em fase inicial de compreensão. Tem como alteração histopatológica típica um arranjo lobular dos capilares na base da derme. O tratamento é cirúrgico, com baixa taxa de recidiva; há alternativas não-cirúrgicas. **Relato do Caso:** Trata de um paciente de 25 anos, que 2 anos após realizar transplante renal de doador falecido desenvolveu um granuloma piogênico gigante em antebraço direito após um trauma leve. Realizou sucessivas excisões cirúrgicas, apresentando recidivas, e evoluindo com resolução apenas após suspensão do tacrolimus e realização de radioterapia. As peculiaridades deste caso são: *status* de pós-transplante renal, grande tamanho, recidivas após cirurgia e realização de radioterapia. **Conclusões:** Um paciente com granuloma piogênico, com evolução atípica, teve desfecho favorável após identificação e retirada de fator causal e terapia alternativa. Porém, este relato tem limitado potencial de generalização. Há poucas publicações de séries de casos envolvendo situações não-usuais, além do acometimento de mucosa oral, regiões paraungueais/subungueais e casos em gestantes. A radioterapia é uma intervenção pouco realizada, que pode ter valor em casos refratários. Mais estudos são necessários para descrever alternativas de tratamento, bem como confirmar a importância da descontinuação do tacrolimus na resposta clinica.

Descritores: Granuloma piogênico; Transplante de Rim; Tacrolimo; Procedimentos Cirúrgicos Ambulatórios; Braquiterapia.

INTRODUCTION

Pyogenic granuloma is a common benign skin lesion[1], also called lobular capillary hemangioma[2], more common in the oral mucosa[3–5], especially in pregnant women[6,7]; it is also common in paraungual/subungual regions[8]. It is usually triggered by trauma or medications[8]. It usually responds well to surgical approaches, with a low recurrence rate [9].

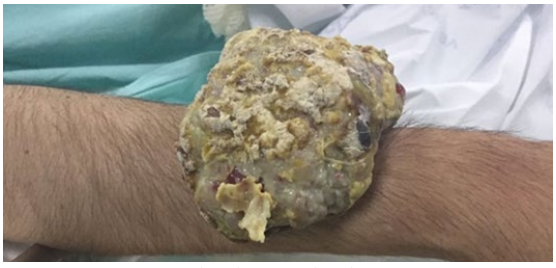
There are a few cases related to kidney transplantations[10–12], with two patientes taking cyclosporine and one with tacrolimus.

In this study, we report a case of pyogenic granuloma in a young male kidney transplant patient with a giant lesion located on the forearm, with a probable etiology related to the calcineurin inhibitor used in the immunosuppressive regimen and with an atypical therapeutic response.

Case description

A 25-year-old male patient with CKD secondary to nephrocalcinosis, on hemodialysis for 2 years, underwent kidney transplantation from a deceased donor at the Walter Cantídio University Hospital, in Fortaleza, Federative unit of Ceará - Brazil. Thymoglobulin 3mg/kg was used for induction immunosuppression and maintenance with sodium mycophenolate, tacrolimus, and prednisone. Deceased donor, male, 37 years old: brain death due to trauma, initial creatinine of 1.1mg/dL and terminal creatinine of 0.6mg/dL. The cold ischemia time was 12 hours and 50 minutes. The kidney transplant progressed without delayed graft function or acute rejection, and the patient was discharged from hospital after 8 days, with creatinine of 2.0 mg/dL on the following 28 days. Regarding the complications post-transplant, 2 episodes of CMV infection were reported (positive viral DNA test, without manifestations of disease) in the first 3 months and 28 days after transplantation, and the following 7 months after, treated preventively with ganciclovir. The patient also had a BKV infection, 10 months after the transplant, which resolved with a reduction in the dose of mycophenolate sodium.

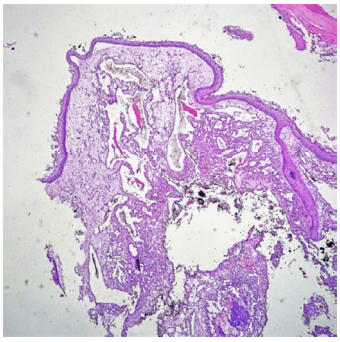
After 22 months of transplantation, he began to present a lesion on his right forearm, vegetative, pedicled, expansive, friable and covered in purulent secretion after excoriation due to contact with a wooden fence, training with a foreign body (splinter) for 2 days. He then underwent treatment with cephalexin for 7 days without improvement. The lesion progressively increased in size, reaching 13 cm in largest diameter (Fig. 1):



Authors' personal archive.

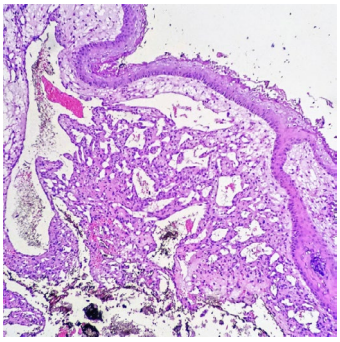
Figure 1.: Vegetating lesion on patient's forearm.

He was admitted to the post-kidney transplant reference service and underwent antibiotic therapy with oxacillin. At the time, he denied fever, change in appetite, maintaining a good disposition and good general condition. A culture of the lesion showed growth of *Enterococcus faecalis*. Antibiotic therapy was escalated to teicoplanin with a combination of ciprofloxacin, and similarly, there was no regression. A lesion biopsy was then performed, demonstrating the proliferation of capillary form vessels in a lobular arrangement, accompanied by edema, predominantly neutrophilic inflammatory infiltration, and extensive areas of ulceration compatible with pyogenic granuloma (Figs. 2 and 3). It was the first post-transplant case diagnosed in Brazil post-kidney transplant. No investigations for fungi and mycobacteria (special stains, cultures) were conducted.



Source: Archive from HUWC.

Figure 2. Dermis with the proliferation of capillary form vessels in a lobular arrangement, accompanied by edema and inflammatory infiltrate (HE, 40x)

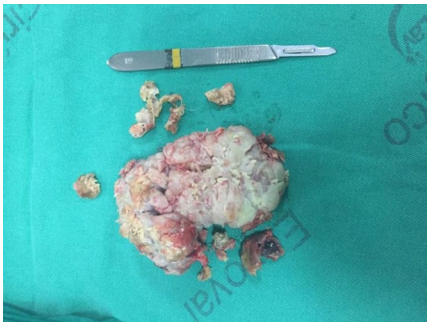


Source: Archive from HUWC.

Figure 3. Detail of a lobular arrangement of capillary-form vessels, with edema and surrounding inflammatory infiltrate (HE, 100x).

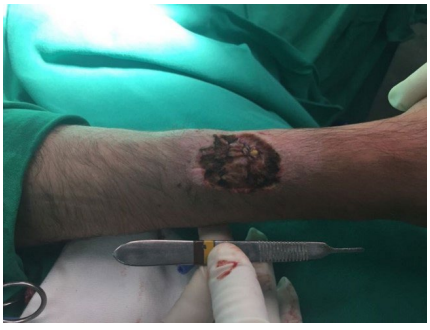
An MRI of the forearm showed expansive pedunculated formation in the right forearm, with signs of high vascularization, non-locally invasive, which favors, in this clinical context, the histopathological report of pyogenic granuloma.

It was decided to undergo surgical treatment. Total excision was performed with a cold scalpel, without electrocautery (Fig.4 and 5):



Source: Authors' personal archive.

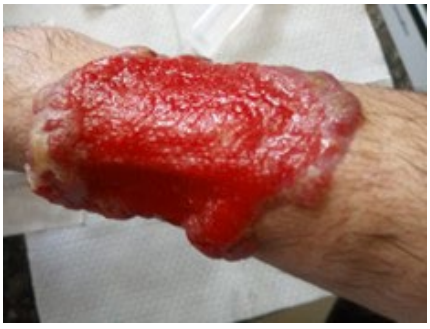
Figure 4. Surgical specimen of vegetative lesion.



Source: Authors' personal archive.

Figure 5. Operative wound, immediate post- operative.

Upon return for plastic surgery, which was initially aimed at skin grafting, recurrence of the lesion was detected (Fig. 6):

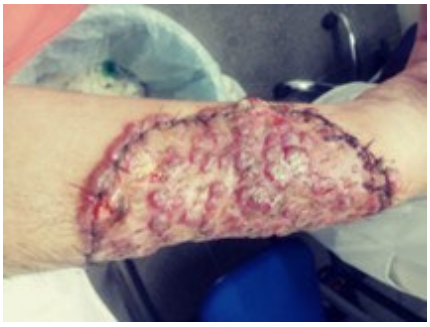


Authors' personal archive.

Figure 6. First recurrence in the forearm.

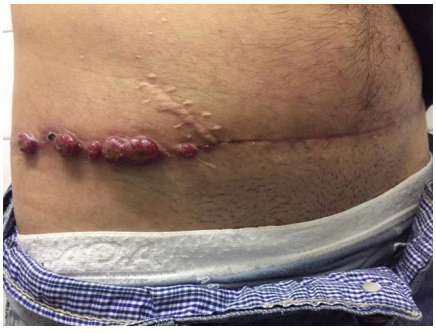
In the context of recurrence, the approach was modified to enlarge the edges, performed without electrocautery. The abdominal skin graft schedule was maintained in an attempt to block the return of growth of the lesion.

The patient presented a second recurrence of the injury on the forearm (Fig. 7) and signs of a similar injury at the site of skin graft removal (Fig. 8)



Authors' personal archive.

Figure 7. Second recurrence of pyogenic granuloma.

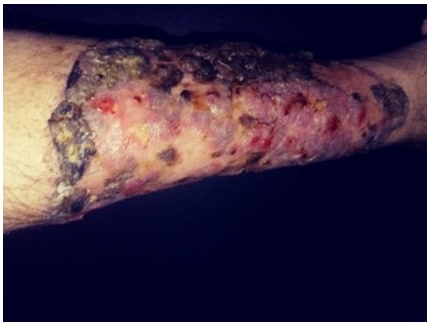


Source: Authors' personal archive.

Figure 8. Lesion at skin donor site.

A third lesion excision was performed with a cold scalpel and hemostasis by electrocautery. In the etiological evaluation, Anti-HHV8 immunohistochemistry was negative. Complementary radiotherapy and change in immunosuppression were then started, with tacrolimus discontinued and replaced by everolimus, while mycophenolate and prednisone were maintained.

After these procedures, radiotherapy was completed with a total dose of 30 Gy, divided into 15 fractions, with 10MeV electrons and progressed with total remission of the lesion in the forearm and abdomen (Fig. 9)



Source: Authors' personal archive.

Figure 9. Appearance of the forearm injury after brachytherapy.

DISCUSSION

Pyogenic granuloma is a common, acquired, benign vascular lesion that affects the skin and mucous membranes[1]. It was originally described by Poncet and Dor in 1897[13, 14]. It has common locations in oral mucosa[3–5], especially in pregnant women[6,7], adult women and children [4,5], and subungual and periungual region [8]. In adults, there is a predilection for the trunk and extremities, as observed

in the present case. Atypical locations include: Nasal Cavity (128 cases[15]); scalp (2 cases[16]) intravenous (em mão [17], periadrenal[18]); gastrointestinal tract (esophagus[19], stomach[20] and ileum[21]); and penis[22]

It most often occurs after trauma[8], generally mild and chronic, but there are reports of cases with single trauma[23], as in this case. There may be other factors, such as medications[8,24–30] (including cyclosporine[11,12,31], topical tacrolimus[32] and oral tacrolimus[10]), Infections (candida[19], sinusitis[33]) and transplantation (autogenic capillary[34], bone marrow[27,31] liver[35]). In the case reported, we observed a history of single trauma, as well as the use of tacrolimus, as possible triggering factors for the injury.

It is usually small in size, not exceeding 2 cm, but there are cases described of single giant granulomas[23,36,37], often in individuals with immunological dysfuntion[38], just like the patient in this report.

There is a single published case that is significantly similar to this report. Baykan, in Turkey1, treated a post-kidney transplant patient, using oral tacrolimus, with giant pyogenic granuloma on the forearm, which responded well to surgical excision but presented recurrence at the edge of the skin graft, responding well to chemical cauterization with AgNo[3]. There were no further recurrences in three months.

The pathophysiology of pyogenic granuloma involves a hyperplastic neoplastic response to an angiogenic stimulus with an imbalance of promoters and inhibitors [1,24]. One study revealed markers of embryonic stem cells in endothelial cells and a more differentiated pattern in the interstitial cell, suggesting new vasculogenesis from primitive stem cells[39]; other markers are: mitogen-activated protein kinase[40], mutations with somatic activation of RAS[41]; activation of MAPK/ERK signaling pathway, independent of BRAF, KRAS, HRAS, NRAS, GNA11 and GNA14[42].

The pathological findings are: polypoid lesion with a lobular arrangement of capillaries at the base; the epidermis overlying the granuloma may be flat and atrophic, and ulcerated; At the base of the lesion, the epidermis is acanthocic, with growth inward - epithelial collarette[2]. Luminal vessels vary in size; superficial stromal edema, capillary dilation, inflammation and granulation tissue may be seen [3].

The differential diagnosis of pyogenic granuloma includes: kaposiform hemangioendothelioma, infantile hemangiomas and vascular malformations [33]. Treatment of pyogenic granuloma involves stopping potentially causing medications and includes surgical and non-surgical options. There is a low recurrence rate after the surgical approach (5,05%), increasing with the use of cauterization[9]. In the present case, the first two excisions of the lesion were without cauterization, but in the most severe episode, electrocauterization was used. The alternative options are chemical cauterization with $AgNO_3$[10], the Holmium Nd/YAG laser[43], embolization and endoscopic resection[20], and radiotherapy[44 apud 9,9,12]. Concomitantly, with the start of radiotherapy treatment, it was decided to descontinue tacrolimus as there are reports with a topical presentation that it could be a cause.

Differential diagnosis of pyogenic granuloma includes: kaposiform hemangioendothelioma, infantile hemangiomas and vascular malformations[33].

The particularities of the case in question are: the large size of the lesion; the context of the patient undergoing a solid organ transplant (there are few other reports in the world), ver the correlation with the use of oral tacrolimus (one case); multiple recurrences after surgery (generally there is no recurrence after excision)[9] therapeutic response only after discontinuing tacrolimus and undergoing radiotherapy, an intervention previously described in only two other cases[45,9,12].

CONCLUSION

Pyogenic granuloma is a rapidly growing benign proliferative skin lesion, the pathogenesis of which is still in the early stages of understanding. Known triggers include trauma, infections and various medications. The injury usually responds well to surgery.

In the present report, the patient was a kidney transplant recipient, which had a large lesion with multiple recurrences after surgery and the therapeutic reponse depended on radiotherapy and discontinuation of tacrolimus.

This report has limited potential to produce generalizations, as it is a case report, mainly because it involves a case with many particularities. There are few publications of case series involving situations different from the usual ones (involvement of the oral mucosa, cases in pregnant women, and periungual/subungual lesions). In Brazil, this is the first case report of a difficult-to-treat pyogenic granuloma in a kidney transplant recipient. Radiotherapy is a rarely performed intervention, which may be valuable in cases refractory to unusual measures. More studies are needed to achieve a greater understanding of this pathology and to to describe alternative treatment options, as well as confirming the importance of discontinuation of tacrolimus in the clinical response.

CONFLICT OF INTEREST

Nothing to declare.

AUTHOR'S CONTRIBUTION

Substantive scientific and intellectual contributions to the study: Cesar TA, Hissa PNG, Oliveira CMC, Gadelha SAC; **Conception and design:** Silva SL; **Data analysis and interpretation:** Oliveira CMC, Silva SL; **Article writing:** Cesar TA; **Critical revision:** Oliveira CMC, Hissa PNG; **Final approval:** Fernandes PFCBC.

DATA AVAILABILITY STATEMENT

All dataset were generated and analyzed in the current study.

FUNDING

Not applicable.

ACKNOWLEDGEMENT

We thank the professionals involved in the case, especially in Pathology, Dermatology and Plastic Surgery.

REFERENCES

1. Giblin AV, Clover AJP, Athanassopoulos A, Budny PG. Pyogenic granuloma - the quest for optimum treatment: Audit of treatment of 408 cases. J Plast Reconstr Aesthetic Surg. 2007;60(9):1030-5. https://doi.org/10.1016/j.bjps.2006.10.018
2. Patrice SJ, Wiss K, Mulliken JB. Pyogenic granuloma (Lobular Capillary Hemangioma): A Clinicopathologic Study of 178 Cases. Pediatr Dermatol. 1991;8(4):267-76. https://doi.org/10.1111/j.1525-1470.1991.tb00931.x
3. Mills SE, Cooper PH, Fechner RE. Lobular capillary hemangioma: The underlying lesion of pyogenic granuloma. A study of 73 cases from the oral and nasal mucous membranes. Am J Surg Pathol. 1980 ;4(5):470-9. Avialble at https://pubmed.ncbi.nlm.nih.gov/7435775/. Acessed on 03feb 2020.
4. Saravana GHL. Oral pyogenic granuloma: A review of 137 cases. Br J Oral Maxillofac Surg. 2009;47(4):318-9. https://doi.org/10.1016/j.bjoms.2009.01.002
5. Gordón-Núñez MA, De Vasconcelos Carvalho M, Benevenuto TG, Lopes MFF, Silva LMM, Galvão HC. Oral pyogenic granuloma: A retrospective analysis of 293 cases in a Brazilian population. J Oral Maxillofac Surg. 2010;68(9):2185-8. https://doi.org/10.1016/j.joms.2009.07.070
6. Kroumpouzos G, Cohen LM. Dermatoses of pregnancy. J Am Acad Dermatol. 2001;45(1):1-9. https://doi.org/10.1067/mjd.2001.114595
7. Bett JVS, Batistella EÂ, Melo G, Munhoz E de A, Silva CAB, Guerra EN da S, et al. Prevalence of oral mucosal disorders during pregnancy: A systematic review and meta-analysis. Journal of Oral Pathology and Medicine. 2019;48(4):270-277. https://doi.org/10.1111/jop.12831
8. Piraccini BM, Bellavista S, Misciali C, Tosti A, De Berker D, Richert B. Periungual and subungual pyogenic granuloma. Br J Dermatol. 2010;163(5):941-53. https://doi.org/10.1111/j.1365-2133.2010.09906.x
9. Lee J, Sinno H, Tahiri Y, Gilardino MS. Treatment options for cutaneous pyogenic granulomas: A review. Journal of Plastic, Reconstructive and Aesthetic Surgery. 2011;64(9):1216-20. https://doi.org/10.1016/j.bjps.2010.12.021
10. Baykan H, Ozyurt K, Ozkan F, Sen H, Altınoluk B, Ozkose M. Giant pyogenic granuloma in a renal transplant patient. Eur J Plast Surg. 2013;36(4):271–4. https://doi.org/10.1007/s00238-012-0705-3
11. Al-Zayer M, Fonseca M, Ship JA. Pyogenic granuloma in a renal transplant patient: case report. Spec Care Dent [Internet]. 2001;21(5):187–90. https://doi.org/10.1111/j.1754-4505.2001.tb00253.x
12. Le Meur Y, Bedane C, Clavère P, Peyronnet P, Leroux-Robert C. A proliferative vascular tumour of the skin in a kidney-transplant recipient (recurrent pyogenic granuloma with satellitosis). Nephrol Dial Transplant. 1997;12(6):1271-3. https://doi.org/10.1093/ndt/12.6.1271
13. Poncet A, DL. Botryomycose humaine. Rev Chir. 1897. Acessed on 17 jan. 2020;18:996–1003.
14. Marla V, Shrestha A, Goel K, Shrestha S. The histopathological spectrum of pyogenic granuloma: A case series. Case Rep Dent. 2016;2016:1323798. https://doi.org/10.1155/2016/1323798
15. Lopez A, Tang S, Kacker A, Scognamiglio T. Demographics and etiologic factors of nasal pyogenic granuloma. Int Forum Allergy Rhinol. 2016;6(10):1094–7. https://doi.org/10.1002/alr.21781

16. Chandra BS, Rao PN. Two cases of giant pyogenic granuloma of scalp. Indian Dermatol Online J. 2013;4(4):292-295. https://doi.org/10.4103%2F2229-5178.120640

17. Joethy J, Al Jajeh I, Tay SC. Intravenous pyogenic granuloma of the hand - a case report. Hand Surg. 2011;16(1):87–9. https://doi.org/10.1142/s0218810411005126

18. Risio D, Selvaggi F, Viola P, Lattanzio G, Legnini M, D'Aulerio A, et al. Intravenous pyogenic granuloma of the right adrenal gland: report of a case. Surg Today. 2013;43(5):569–73. https://doi.org/10.1007/s00595-012-0261-2

19. Suarez-Zamora DA, Rodriguez-Urrego PA, Solano-Mariño J, Sierra-Arango F, Palau-Lazaro MA. Esophageal Pyogenic granuloma: A Case Report and Review of the Literature. Int J Surg Pathol. 2018;26(8):735–8. https://doi.org/10.1177/1066896918773476

20. Kusakabe A, Kato H, Hayashi K, Igami T, Hasegawa H, Tsuzuki T, et al. Pyogenic granuloma of the stomach successfully treated by endoscopic resection after transarterial embolization of the feeding artery. J Gastroenterol. 2005;40(5):530–5. https://doi.org/10.1007/s00535-004-1579-3

21. Tanaka A, Kamada T, Hirakawa K, Koga H, Fujimura Y, Iida M, et al. Pyogenic granuloma in the ileum. Dig Endosc. 2007;19(4):189–91. https://doi.org/10.1111/j.1443-1661.2007.00747.x

22. Akbulut F, Akbulut T, Kucukdurmaz F, Sonmezay E, Simsek A, Gurbuz G. Huge Pyogenic granuloma of the Penis. Case Rep Urol. 2015;2015:263168. https://doi.org/10.1155/2015/263168

23. De Carvalho FK, Pinheiro TN, Arid J, De Queiroz AM, De Rossi A, Nelson-Filho P. Trauma-induced giant pyogenic granuloma in the upper lip. J Dent Child. 2015;82(3):168–70. Available at https://pubmed.ncbi.nlm.nih.gov/26731254/. Acessed on 8 dec. 2019.

24. Piguet V, Borradori L. Pyogenic granuloma-like lesions during capecitabine therapy . British Journal of Dermatology. 2002;147(6):1270-2. https://doi.org/10.1046/j.1365-2133.2002.05000_6.x

25. High WA. Gefitinib: A cause of pyogenic granulomalike lesions of the nail. Archives of Dermatology. 2006;142(7):939. https://doi.org/10.1001/archderm.142.7.939-a

26. Curr N, Saunders H, Murugasu A, Cooray P, Schwarz M, Gin D. Multiple periungual pyogenic granulomas following systemic 5-fluorouracil. Australas J Dermatol. 2006;47(2):130-3. https://doi.org/10.1111/j.1440-0960.2006.00248.x

27. Lee L, Miller PA, Maxymiw WG, Messner HA, Rotstein LE. Intraoral pyogenic granuloma after allogeneic bone marrow transplant. Report of three cases. Oral Surgery, Oral Med Oral Pathol. 1994;78(5):607-10. https://doi.org/10.1016/0030-4220(94)90173-2

28. Devillers C, Vanhooteghem O, Henrijean A, Ramaut M, De La Brassinne M. Subungueal pyogenic granuloma secondary to docetaxel therapy. Clinical and Experimental Dermatology. 2009;34(2):251-2. https://doi.org/10.1111/j.1365-2230.2008.02799.x

29. Bouscarat F, Bouchard C, Bouhour D. Paronychia and pyogenic granuloma of the great toes in patients treated with indinavir. New England Journal of Medicine. 1998;338(24):1776-7. https://doi.org/10.1056/nejm199806113382417

30. Wollina U. Systemic Drug-induced Chronic Paronychia and Periungual Pyogenic granuloma. Indian Dermatol Online J [Internet]. 2018;9(5):293–8. https://doi.org/10.4103/idoj.idoj_133_18

31. Kanda Y, Arai C, Chizuka A, Suguro M, Hamaki T, Yamamoto R, et al. Pyogenic granuloma of the tongue early after allogeneic bone marrow transplantation for multiple myeloma. Leuk Lymphoma. 2000;37(3–4):445–9. https://doi.org/10.3109/10428190009089447

32. Tsambaos D, Badavanis G, Monastirli A, Pasmatzi E. Pyogenic granuloma on Facial Skin Associated With Long-Term Topical Pyogenic granuloma on Facial Skin Associated With Long-Term Topical Application of Tacrolimus. Hosp CHRONICLES. 2019;14(2):60–62. Availble at https://www.researchgate.net/publication/338127425_Pyogenic_Granuloma_on_Facial_Skin_Associated_With_Long-Term_Topical_Application_of_Tacrolimus. Acessed on 3 jan. 2020.

33. Putra J, Rymeski B, Merrow AC, Dasgupta R, Gupta A. Four cases of pediatric deep-seated/subcutaneous pyogenic granuloma: Review of literature and differential diagnosis. J Cutan Pathol. 2017;44(6):516–22. https://doi.org/10.1111/cup.12923

34. Sarnoff DS, Goldberg DJ, Greenspan AH, Albom MJ. Residents'Corner: Multiple Pyogenic granuloma-like Lesions Following Hair Transplantation. J Dermatol Surg Oncol. 1985;11(1):32–4. https://doi.org/10.1111/j.1524-4725.1985.tb02888.x

35. Chu P, LeBoit PE. An eruptive vascular proliferation resembling acquired tufted angioma in the recipient of a liver transplant. J Am Acad Dermatol. 1992;26(2 Pt 2):322-5. https://doi.org/10.1016/0190-9622(92)70046-i

36. Dissemond J, Grabbe S. Giant pyogenic granuloma. CMAJ. 2008;178(1):25-26. https://doi.org/10.1503/cmaj.070043

37. Shivaswamy S, Sanjay Jain A, Tambwekar S, Siddiqui N, Koshy A, Shankar A. A rare case of generalized pyogenic granuloma: A case report. Quintessence Int (Berl). 2011;42(6):493-9. Availble at https://pubmed.ncbi.nlm.nih.gov/21519587/. Acessed on 5 jan. 2020.

38. Plovanich M, Tsibris HC, Lian CG, Mostaghimi A. Giant pyogenic granuloma in a patient with chronic lymphocytic leukemia. Case Rep Dermatol. 2014;6(3):227-31. https://doi.org/10.1159%2F000367935

39. Blackwell MG, Itinteang T, Chibnall AM, Davis PF, Tan ST. Expression of embryonic stem cell markers in pyogenic granuloma. J Cutan Pathol. 2016;43(12):1096-1101. https://doi.org/10.1111/cup.12786

40. Arbiser JL, Weiss SW, Arbiser ZK, Bravo F, Govindajaran B, Caceres-Rios H, et al. Differential expression of active mitogen-activated protein kinase in cutaneous endothelial neoplasms: Implications for biologic behavior and response to therapy. J Am Acad Dermatol. 2001;44(2):193-7. https://doi.org/10.1067/mjd.2000.111632

41. Lim YH, Douglas SR, Ko CJ, Antaya RJ, McNiff JM, Zhou J, et al. Somatic activating RAS mutations cause vascular tumors including pyogenic granuloma. Journal of Investigative Dermatology. 2015;135(6):1698-1700. https://doi.org/10.1038/jid.2015.55

42. Pereira TDSF, de Amorim LSD, Pereira NB, Vitório JG, Duarte-Andrade FF, Guimarães LM, et al. Oral pyogenic granulomas show MAPK/ERK signaling pathway activation, which occurs independently of BRAF, KRAS, HRAS, NRAS, GNA11, and GNA14 mutations. J Oral Pathol Med [Internet]. 2019;48(10):906–10. https://doi.org/10.1111/jop.12922

43. Yang C, Liu S. Treatment of giant pyogenic granuloma with the Nd/YAG holmium laser: A case report. J Cosmet Laser Ther. 2013;15(4):225–7. https://doi.org/10.3109/14764172.2013.769270

44. Hamilton R, Nicholas G, Royster HP. Recurrent pyogenic granuloma. Plast Reconstr Surg. 1968;41(2):145–8. http://doi.org/10.1097/00006534-196802000-00008