Rheumatol Int (2017) 37:1207–1212
DOI 10.1007/s00296-017-3690-9

Rheumatology INTERNATIONAL

CASES WITH A MESSAGE

# Use of etanercept to treat rheumatoid arthritis in an HIV-positive patient: a case-based review

**Shen-ju Liang[1] · Quan-you Zheng[2] · Yan-long Yang[1] · Yi Yang[1] · Chong-yang Liu[1]**

Received: 7 November 2016 / Accepted: 22 February 2017 / Published online: 2 March 2017


**Abstract** Rheumatoid arthritis (RA) is a relatively common autoimmune disease that is associated with progressive disability and systemic complications, with a relatively high socioeconomic burden. The treatment of RA has been revolutionized by the use of biological drugs, such as anti-tumor necrosis factor (TNF) agents. A wide spectrum of RA disease severity has been reported among patients with human immunodeficiency virus (HIV) infection. Yet, only a few cases using anti-TNF therapy have been described in this clinical population. Therefore, the aim of our case-based review was to describe the successful use of etanercept in a 38-year-old female patient with RA concomitant with HIV infection, who had been resistant to the first-line anti-rheumatic therapies. As per routine care guidelines, the patient was screened for hepatitis virus infection, latent tuberculosis, and other infectious conditions, prior to the initiation of etanercept treatment. CD4 cell count, HIV viral load, and adverse effects were closely monitored during the treatment. The HIV infection remained stable with etanercept treatment, without the need for anti-retrovirus agents. No adverse effects and serious infections were identified during the treatment. Therefore, anti-TNF therapy is a viable alternative for the treatment of RA in patients with HIV, who do not respond to conventional anti-rheumatic therapies. The relationship between TNF-α and HIV infection, as well as cautionary guidelines regarding the utilization of anti-TNF therapy in this clinical population, is discussed.

**Keywords** Rheumatoid arthritis · Human immunodeficiency virus infection · Anti-TNF-α therapy · Etanercept

## Introduction

Rheumatoid arthritis (RA) is a systemic chronic autoimmune disease of unclear etiology that primarily involves the articular joints, but can also lead to several extra-articular manifestations [1–4]. Studies have reported a wide spectrum of RA disease severity among patients with human immunodeficiency virus (HIV) infection [5, 6]. Dealing with these two concurrent diseases is a great challenge for physicians, as management of RA requires the use of immunosuppressant drugs and/or corticosteroids that could potentially promote HIV virus replication and facilitate the progression of the disease [7]. Therefore, evaluation of the effectiveness and safety of anti-rheumatic drugs to control the disease progression of RA among patients with HIV infection is required to ensure that they do not interfere with the HIV infection progression [7].

Tumor necrosis factor alpha (TNF-α), which plays a vital role in host defense against intra-cellular pathogens, is a key pro-inflammatory cytokine that promotes the progression of both RA and HIV infection [8, 9]. The treatment of RA has been revolutionized by the use of biological drugs, such as anti-TNF agents [10, 11]. However, little is known about the concomitant influence of anti-TNF therapy on RA and HIV infection. A few cases have been published documenting the use of TNF-α inhibitors in patients with concurrent RA and HIV (RA–HIV) [12–14]. Therefore, the

✉ Chong-yang Liu
dpyylcy2004@163.com

[1] Division of Rheumatology, Daping Hospital, Third Military Medical University, Chongqing 400042, China

[2] Department of Nephrology, Southwest Hospital, Third Military Medical University, Chongqing 400038, China

aim of our case-based review was to describe the successful treatment of a 38-year-old female patient with concomitant RA and HIV infection, who was treated with etanercept (ETN), a soluble TNF receptor (p75): FC fusion protein, following failure of treatment using standard modifying antirheumatic drugs (DMARDs) therapy. We complement our case report with a focused review of existing literature regarding the use of ETN in RA-HIV patients.

## Case report

In February 2010, a 38-year-old woman presented to our rheumatology clinic for the management of her RA status. She had been diagnosed with RA 5 years previously, based on the presentation of symmetrical polyarthritis (involving the shoulders, knees, wrists, and metacarpophalangeal and proximal interphalangeal joints), morning stiffness, and positive testing results for rheumatoid factor (RF) and anti-cyclic citrullinated protein (anti-CCP). Her previous medical history was positive for asthma and surgical management of an ectopic pregnancy. At the time of presentation, her treatment included the use of hydroxychloroquine (HCQ), leflunomide (LEF) and methotrexate (MTX), with an unsatisfactory control of her RA disease severity. Physical examination revealed active synovitis of the proximal interphanlangeal and metacarpophalangeal joints, shoulders, and knees.

Routine blood analysis (Table 1) and a radiological examination were performed. Results of the initial blood tests were noticeable, with marked elevation of inflammatory factor levels, including C-reactive protein (CRP), erythrocyte sedimentation rate (ESR), and interleukin 6 (IL-6). Additionally, serum RF, anti-CCP antibodies, and anti-nuclear antibodies titers were present. Routine screening results for common opportunistic infections, such as tuberculosis, was negative. Radiograph examination of both hand and knee joints revealed bilateral metacarpophalangeal joint erosions and joint space narrowing.

Despite the utilization of optimal DMARDs, the patient's active RA status remained unchanged, even with the addition of oral steroids tapers (15 mg/d). The severity of her RA symptoms had forced the patient to stop working, the patient reporting being depressed and intermittently stopping her medication use and frequently changing her medications. In March 2012, ETN (25 mg/week) was added to her RA drug therapy, with remarkable and rapid improvement in RA disease manifestation (Fig. 1). Over the next 2 years, the patient continued to use ETN as required.

**Table 1** Laboratory results

| Value | Normal range | Results |
|---|---|---|
| White blood cell (WBC) count | 3.5–9.5 ($\times 10^9$/L) | 8.71 |
| Neutrophils | 1.8–6.3 ($\times 10^9$/L) | 6.44 |
| Eosinophils | 0.02–0.52 ($\times 10^9$/L) | 0.33 |
| Lymphocytes | 1.1–3.2 ($\times 10^9$/L) | 1.28 |
| Hemoglobin (HB) | 115–150 (g/L) | 107.0 |
| Platelet (PLT) | 94–268 ($\times 10^9$/L) | 152.0 |
| C-reactive protein (CRP) | 0.0–8.0 (mg/L) | 48.0 |
| Erythrocyte sedimentation rate (ESR) | 0.0–30 (mm/h) | 58.0 |
| Rheumatic factor (RF) | 0.0–30.0 (KIU/L) | 96.1 |
| Interleukin-6 protein (IL-6) | 0–7 (pg/mL) | 62.7 |
| Albumin (ALB) | 40.0–55.0 (g/L) | 39.9 |
| Serum globulin (GLB) | 20.0–40.0 (g/L) | 42.0 |
| Urea | 2.90–8.20 (mmol/L) | 3.78 |
| Creatinine | 53.0–97.0 (umol/L) | 79.8 |
| Aspartate aminotranspherase (AST) | 13.0–35.0 (U/L) | 19.6 |
| Alanine aminotransferase (ALT) | 7.0–40.0 (U/L) | 20.6 |
| Complement C3 | 0.79–1.52 (g/L) | 0.77 |
| Complement C4 | 0.16–0.38 (g/L) | 0.20 |
| Anti-citrullinated protein antibody (Anti-CCP) | – | High positive |
| Anti-nuclear antibody (Anti-nuclear Ab.) | – | Positive |
| Anti-keratin antibody (Anti-AKA) | – | Negative |
| Anti-Smith protein antibodies (Anti-SM) | – | Negative |
| Tuberculosis test (T-SPOT) | – | Negative |

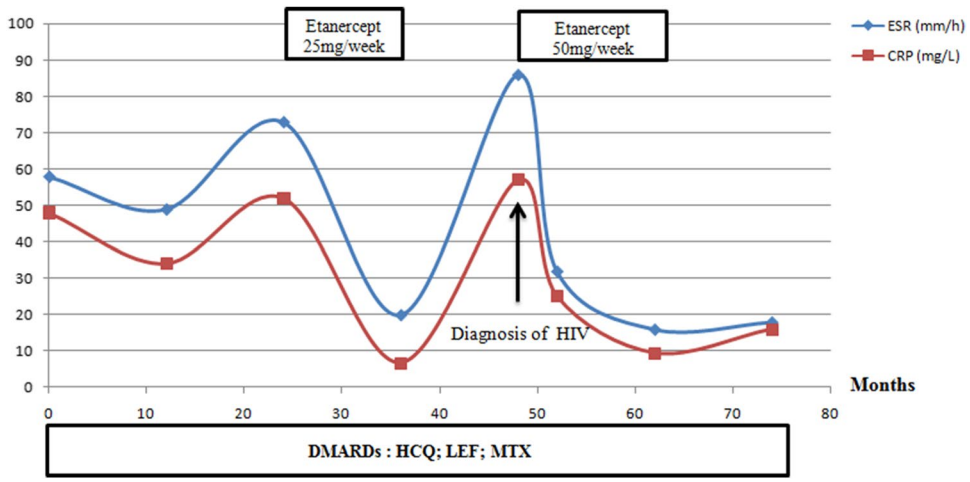


**Fig. 1** Erythrocyte sedimentation rate (ESR) and C-reactive protein (CRP) serum levels throughout the entire follow-up, pointing-up correlations with treatments, and HIV infection

In January 2014, the patient tested positive for HIV, with a $CD4^+$T cell count of 481/$mm^3$ and a virus load of 20 copies/mL. Owing to the marked RA activity and seriousness of the swelling of her joints at that time, ETN (50 mg/week) was added to her treatment. In March 2014, after 10 subcutaneous infusions of ETN, the patient was deemed to be in clinical remission of RA, with no active joints identified and CRP level <8 mg/L (Fig. 1). Routine use of ETN was subsequently maintained for a period of nine months, with cessation of steroid therapy. No opportunistic infections developed over the time-period of ETN. In February 2016, the HIV infection remained stable, with a virus load <20 copies/mL and a $CD4^+$T cell count of 516/$mm^3$. No anti-retrovirus drugs were used throughout the biological treatment course for RA.

## Discussion

In this case, we describe the successful use of ETN to treat a patient with severe RA and concomitant HIV infection. Although the patient had been resistant to optimal DMARDs, the addition of ETN produced rapid and remarkable improvements in the patient's RA disease status (Figs. 1, 2), with benefits maintained over the 30-month follow-up period. Her HIV disease status remained stable without use of any anti-retrovirus agents, with no development of opportunistic infections or adverse effects.

Over the past decades, the treatment of RA has significantly evolved with the introduction of several biological anti-TNF therapies, providing excellent symptomatic remission in many patients with RA. ETN, one of the most widely utilized anti-TNF medications, has been proven to be effective and relatively safe in several clinic studies [15, 16]. Since the comorbid occurrence of RA and HIV infection is rare, the effectiveness and safety of ETN in these patients has only been reported in a few case reports and thus remains unclear. To best of our knowledge, a retrospective review of the published literature was performed by searching the PubMed and MEDLINE databases using the key words "rheumatic arthritis," "HIV" and "etanercept" (period 2000–2016). Only articles available in

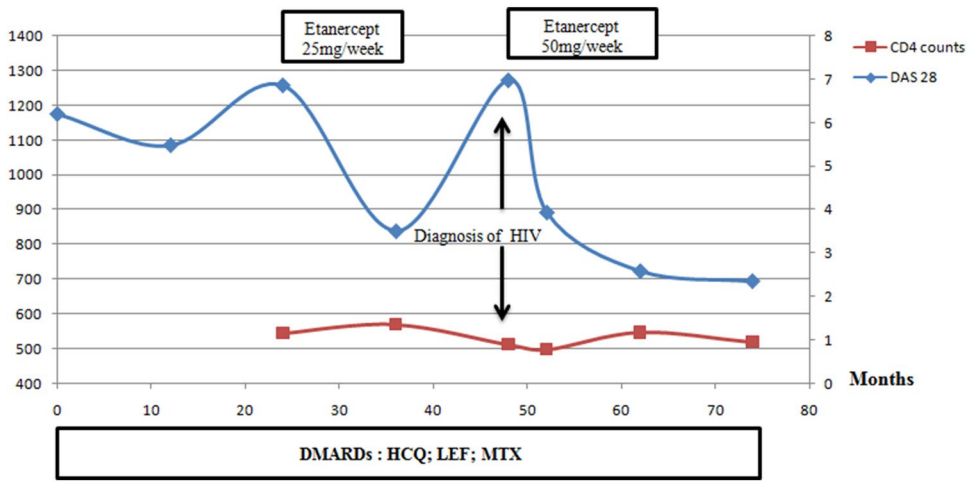


**Fig. 2** DAS 28 scores and $CD4^+$ lymphocytes ($mm^{-3}$) during the treatment of RA with etanercept

English were reviewed. Except for 4 irrelevant articles, the remaining 3 case reports were included in this review (summarized in Table 2).

Kaur et al. [12] described the case for a 44-year-old man with a long history of RA, with concomitant HIV, HBV and HCV infection. Highly active anti-retrovirus therapy (HAART) was used because of the low absolute CD4 count (299/mm$^3$) at first presentation in 1999. With progression of the severity of the active arthritis and poor outcomes with DMARDs, TNF antagonists were added to the patient's drug therapy. The patient developed an allergic reaction after three infusions of infliximab, which required discontinuation of this drug. The patient was subsequently treated using ETN (50 mg/week), with a good clinical response of RA symptoms, with CD4 count increasing to 530/mm$^3$ and HIV virus replications decreasing to <50 copies/mL. No opportunistic infections or adverse events were reported.

In 2008, Cepeda et al. described the outcomes of two patients with RA and HIV who were treated with ETN for at least a 12-month period [13]. An excellent response to ETN was identified in both cases, with no opportunistic infections reported, with no anti-retrovirus treatment required in one patient. The absolute CD4 count and HIV virus load were closely monitored throughout the treatment, with no evidence of HIV progression or deterioration in CD4 count.

Finally, De Nardo et al. [14] reported on ETN treatment for a woman with RA and HIV (CD4 >500 cells/mm$^3$, virus load <50 copies/mL). Again, a dramatic improvement in RA disease status was reported within 2 weeks of treatment onset. However, this patient did progress to septic shock and multiple organ failure after receiving a seasonal influenza vaccine, with adjuvant, 2 weeks after onset of ETN treatment. Despite plasma exchange, the patient's clinical condition deteriorated rapidly, with diagnosis of acute respiratory distress syndrome and kidney failure. The patient was intubated, with hemodialysis and antibiotic therapy initiated. The patient survived the acute episode and her condition gradually improved.

Consistent with the above results, our patient had an excellent response to ETN, despite her positive HIV infection status, with reduced joint swelling and decreased acute-phase inflammation markers (Fig. 1), progressing to complete clinical remission of her RA status (Fig. 2). The HIV infection was stable and no anti-retrovirus drugs were required, with no incidence of opportunistic infection or adverse effects. Additionally, it was reported that anti-TNF therapies, including ETN, can be successfully used for the treatment of HIV-associated arthritis in patients with a stable HIV infection status and CD4$^+$ lymphocyte counts [17]. Other studies have confirmed the effectiveness and safety of using ETN for the management of psoriasis and psoriasis-related arthritis in patients with HIV infection, over long-term follow-up [18–20]. Therefore, TNF-alpha antagonists can provide an effective and safe treatment option for RA in patients with a positive HIV infection status, and may, in fact, attenuate the progression of the HIV infection. The mechanisms underlying the effect of TNF-alpha antagonists on the HIV infection remain unclear.

**Table 2** Reported cases of RA concomitant with HIV, treated with TNF inhibitors

| Case | Author | Sex/age | Taking ART | Initial CD4 (cells/mm$^3$); VL (copies/mL) | Lasted reported CD4 (cells/mm$^3$); VL (copies/mL) | Treatment | Clinical response | Reported treatment length | Complications |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Kaur et al. [13] | M/44 | Yes | 236; 115 | 530; <50 | Infliximab etanercept | Good response | Not available | Allergic reaction after using infliximab three times |
| 2 | Cepeda et al. [14] | M/48 | Yes | 631; <50 | 538; <400 | Etanercept | Excellent response | 50 mo | None |
| 3 | Cepeda et al. [14] | F/44 | No | 947; <400 | 1082; <400 | Etanercept | Excellent response | 12 mo | None |
| 4 | De Nardo et al. [15] | F/45 | Yes | >700; <50 | 549; <400 | Etanercept | Good response within the initial 2 weeks | 2 mo and discontinued | Septic shock after influenza vaccination |
| 5 | Present | F/38 | No | 418; 20 | 516; <20 | Etanercept | Excellent response | 30 mo | None |

*ART* antiretroviral therapy, *VL* viral load, *M* male, *F* Female, *mo* month

Previous studies have suggested that TNF-α promotes HIV propagation, ultimately leading to the acquired immuno-deficiency syndrome (AIDS) [21]. High TNF-α levels are typically present throughout all stages of HIV infection, with the highest levels detected during presence of concomitant opportunistic infection. Therefore, excessive TNF-α production may aggravate HIV disease status, amplify the loss of immune capacity and, ultimately, result in clinical manifestations of AIDS [22]. A prospective cohort study further reported elevations in serum TNF-α levels in patients treated with anti-retrovirus agents, with levels increasing with progression of the infection status [23]. In vitro studies have also reported that TNF-α promotes the expression of HIV protein through the nuclear factor kappa beta (NF-κB) signaling pathways [24]. HIV-related proteins, such as Gp120 and Nef, further promote the expression of TNF-α via common pathways, which ultimately augment virus propagation and cause apoptosis of uninfected bystander immune cells [9, 25].

Several clinical studies have suggested that anti-TNF therapy could improve the disease status of HIV/AIDs [26–29]. In a randomized trial, ETN was used in six patients with HIV infection who were on a highly active antiretroviral therapy (HAART), with a virus load <5000 copies/mL. Absolute CD4 counts remained stable, with no serious complications attributable to the use of ETN reported [26]. Based on this evidence, strategies to inhibit TNF-α in HIV patients may, theoretically, be of clinical significance.

Considering the critical role of TNF-α in the progressive elimination of intracellular pathogens, anti-TNF therapies may increase the risk of serious opportunistic infections [30, 31]. Several infections have been reported in association with anti-TNF therapies, including bacterial, viral, fungal, and parasitic infections [32]. The development of active tuberculosis among patients on anti-TNF therapies is a serious concern [33]. Due to compromised immune function, HIV-positive patients frequently present with atypical extrapulmonary manifestations or disseminated diseases, which increase the difficulty of effectively managing the HIV infection [34]. Therefore, the use of TNF antagonists should be carefully considered in patients who are at risk for tuberculosis, particularly those who are HIV-positive. Consistent with published guidelines, at-risk patients should undergo routine tuberculosis screening, which, for our patient, were consistently negative [33]. Furthermore, it was suggested that anti-TNF therapies were effective and safe to use in patients with rheumatic disease in whom the underlying HIV infection is stable (restricting use of anti-TNF in patients with a CD4 count $<200/mm^3$ and viral loading <6000 copies/mL at the beginning of the therapy) [13]. Closely monitoring HIV viral load, as well as CD4 count, is of great importance, especially in HIV-infected patients on immune suppressive drugs, such as anti-TNF therapies.

Based on our case review, we propose that anti-TNF therapy is a viable alternative for the treatment of RA in patients with HIV infection who are not responding to conventional DMARDs, as long as the underlying HIV infection status is stable. Awareness of the therapeutic potential of anti-TNF therapies and of potential adverse effects is necessary for an optimal use of anti-TNF in this clinical population [32]. Close monitoring of clinical parameters of HIV infection status, with judicious use of antiretroviral agents, should be considered. Moreover, patients should be screened for latent tuberculosis before implementing anti-TNF therapy. Further clinical studies are needed to provide definitive evidence regarding the effectiveness and safety of anti-TNF agents for RA in patients with HIV.

Written informed consent was obtained from the patient for publication of this report.

**Acknowledgements** We acknowledge those involved in drafting and revising the manuscript. We also acknowledge the Editage by Cactus Communications for editing the manuscript.

**Compliance with ethical standards**

**Conflict of interest** The authors declare that they have no competing interests in this article.

## References

1. Redlich K, Smolen JS (2012) Inflammatory bone loss: pathogenesis and therapeutic intervention. Nat Rev Drug Discov 11(3):234–250. doi:10.1038/nrd3669
2. Scott DL, Wolfe F, Huizinga TW (2010) Rheumatoid arthritis. The Lancet 376(9746):1094–1108. doi:10.1016/S0140-6736(10)60826-4
3. Semerano L, Minichiello E, Bessis N, Boissier MC (2016) Novel immunotherapeutic avenues for rheumatoid arthritis. Trends Mol Med 22(3):214–229. doi:10.1016/j.molmed.2016.01.005
4. McInnes IB, Schett G (2011) The pathogenesis of rheumatoid arthritis. N Engl J Med 365(23):2205–2219. doi:10.1056/NEJMra1004965
5. Lawson E, Walker-Bone K (2012) The changing spectrum of rheumatic disease in HIV infection. Br Med Bull 103(1):203–221. doi:10.1093/bmb/lds022
6. Yao Q, Frank M, Glynn M, Altman RD (2008) Rheumatic manifestations in HIV-1 infected in-patients and literature review. Clin Exp Rheumatol 26(5):799–806
7. Galeazzi M, Giannitti C, Manganelli S, Benucci M, Scarpato S, Bazzani C et al (2008) Treatment of rheumatic diseases in patients with HCV and HIV infection. Autoimmun Rev 8(2):100–103. doi:10.1016/j.autrev.2008.07.009
8. Idriss HT, Naismith JH (2000) TNF alpha and the TNF receptor superfamily: structure-function relationship(s). Microsc Res Tech 50(3):184–195. doi:10.1002/1097-0029(20000801)50:3<184::AID-JEMT2>3.0.CO;2-H
9. Kumar A, Abbas W, Herbein G (2013) TNF and TNF receptor superfamily members in HIV infection: new

cellular targets for therapy? Mediators Inflamm 2013:484378. doi:10.1155/2013/484378
10. Chaabo K, Kirkham B (2015) Rheumatoid Arthritis-Anti-TNF. Int Immunopharmacol 27(2):180–184. doi:10.1016/j.intimp.2015.04.051
11. Geiler J, Buch M, McDermott MF (2011) Anti-TNF treatment in rheumatoid arthritis. Curr Pharm Des 17(29):3141–3154
12. Kaur PP, Chan VC, Berney SN (2007) Successful etanercept use in an HIV-positive patient with rheumatoid arthritis. J Clin Rheumatol 13(2):79–80. doi:10.1097/01.rhu.0000260411.75599.39
13. Cepeda EJ, Williams FM, Ishimori ML, Weisman MH, Reveille JD (2008) The use of anti-tumour necrosis factor therapy in HIV-positive individuals with rheumatic disease. Ann Rheum Dis 67(5):710–712. doi:10.1136/ard.2007.081513
14. De Nardo P, Bellagamba R, Corpolongo A, Gentilotti E, Taglietti F, Rosati S et al (2013) Septic shock after seasonal influenza vaccination in an HIV-infected patient during treatment with etanercept for rheumatoid arthritis: a case report. Clin Vaccine Immunol 20(5):761–764. doi:10.1128/CVI.00081-13
15. Weinblatt ME, Kremer JM, Bankhurst AD, Bulpitt KJ, Fleischmann RM, Fox RI et al (1999) A trial of etanercept, a recombinant tumor necrosis factor receptor: Fc fusion protein, in patients with rheumatoid arthritis receiving methotrexate. N Engl J Med 340(4):253–259. doi:10.1056/NEJM199901283400401
16. Hu D, Bao C, Chen S, Gu J, Li Z, Sun L et al (2009) A comparison study of a recombinant tumor necrosis factor receptor: Fc fusion protein (rhTNFR: Fc) and methotrexate in treatment of patients with active rheumatoid arthritis in China. Rheumatol Int 29(3):297–303. doi:10.1007/s00296-008-0681-x
17. Almoallim H, Jali I, Wali G (2013) Successful use of anti-tumor necrosis factor-alpha biological therapy in managing human immunodeficiency virus-associated arthritis: three case studies from Saudi Arabia. Joint Bone Spine 80(4):426–428. doi:10.1016/j.jbspin.2013.01.002
18. Di Lernia V, Zoboli G, Ficarelli E (2013) Long-term management of HIV/hepatitis C virus associated psoriasis with etanercept. Indian J Dermatol Venereol Leprol 79(3):444. (**PubMed: 23619459**)
19. De Simone C, Perino F, Caldarola G, D'Agostino M, Peris K (2016) Treatment of psoriasis with etanercept in immunocompromised patients: Two case reports. J Int Med Res 44(1 suppl):67–71. (**PubMed: 27683143**)
20. Cobo Ibáñez T, Zamora F, Herranz P, Steiner M (2009) Anti-tumour necrosis factor treatment in HIV-positive patients with psoriatic arthritis. Med Clín 133 (17):682–683. (**PubMed: 19243791**)
21. Gonzalez-Nicolas J, Resino S, Jimenez JL, Alvarez S, Fresno M, Munoz-Fernandez MA (2001) Tumor necrosis factor-alpha and nitric oxide in vertically HIV-1-infected children: implications for pathogenesis. Eur Cytokine Netw 12(3):437–444
22. Tourne L, Durez P, Van Vooren JP, Farber CM, Liesnard C, Heenen M et al (1997) Alleviation of HIV-associated psoriasis and psoriatic arthritis with cyclosporine. J Am Acad Dermatol 37(3 Pt 1):501–502
23. Wada NI, Jacobson LP, Margolick JB, Breen EC, Macatangay B, Penugonda S et al (2015) The effect of HAART-induced HIV suppression on circulating markers of inflammation and immune activation. AIDS 29(4):463–471. doi:10.1097/QAD.0000000000000545
24. Osborn L, Kunkel S, Nabel GJ (1989) Tumor necrosis factor alpha and interleukin 1 stimulate the human immunodeficiency virus enhancer by activation of the nuclear factor kappa B. Proc Natl Acad Sci USA 86(7):2336–2340
25. Wallis RS, Kyambadde P, Johnson JL, Horter L, Kittle R, Pohle M et al (2004) A study of the safety, immunology, virology, and microbiology of adjunctive etanercept in HIV-1-associated tuberculosis. AIDS 18(2):257–264
26. Sha BE, Valdez H, Gelman RS, Landay AL, Agosti J, Mitsuyasu R et al (2002) Effect of etanercept (Enbrel) on interleukin 6, tumor necrosis factor alpha, and markers of immune activation in HIV-infected subjects receiving interleukin 2. AIDS Res Hum Retrovir 18(9):661–665. doi:10.1089/088922202760019365
27. Walker RE, Spooner KM, Kelly G, McCloskey RV, Woody JN, Falloon J et al (1996) Inhibition of immunoreactive tumor necrosis factor-alpha by a chimeric antibody in patients infected with human immunodeficiency virus type 1. J Infect Dis 174(1):63–68
28. Emer JJ (2009) Is there a potential role for anti-tumor necrosis factor therapy in patients with human immunodeficiency virus? J Clin Aesthet Dermatol 2(4):29–35
29. Ting PT, Koo JY (2006) Use of etanercept in human immunodeficiency virus (HIV) and acquired immunodeficiency syndrome (AIDS) patients. Int J Dermatol 45(6):689–692. doi:10.1111/j.1365-4632.2005.02642.x
30. Shale MJ, Seow CH, Coffin CS, Kaplan GG, Panaccione R, Ghosh S (2010) Review article: chronic viral infection in the anti-tumour necrosis factor therapy era in inflammatory bowel disease. Aliment Pharmacol Ther 31(1):20–34. doi:10.1111/j.1365-2036.2009.04112.x
31. Ehlers S (2005) Why does tumor necrosis factor targeted therapy reactivate tuberculosis? J Rheumatol Suppl 74:35–39
32. Ali T, Kaitha S, Mahmood S, Ftesi A, Stone J, Bronze MS (2013) Clinical use of anti-TNF therapy and increased risk of infections. Drug Healthc Patient Saf 5:79–99. doi:10.2147/DHPS.S28801
33. Winthrop KL (2006) Risk and prevention of tuberculosis and other serious opportunistic infections associated with the inhibition of tumor necrosis factor. Nat Clin Pract Rheumatol 2(11):602–610. doi:10.1038/ncprheum0336
34. Adizie T, Moots RJ, Hodkinson B, French N, Adebajo AO (2016) Inflammatory arthritis in HIV positive patients: a practical guide. BMC Infect Dis 16:100. doi:10.1186/s12879-016-1389-2