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# **Tocilizumab and mesenteric arterial thrombosis: drug-drug interaction with anticoagulants metabolized by CYP 450 and/or by P-glycoprotein**

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## **RUNNING HEAD**

Tocilizumab and anticoagulants: drug-drug interaction

## **KEY WORDS**

Tocilizumab, Acute mesenteric arterial thrombosis, Drug interaction, Anticoagulant drugs, Rheumatoid arthritis

## **WORD COUNT**

797 (including references)

## **TABLES AND FIGURES**

0

## **SUMMARY**

### **AIM**

Based on a case report, we analyze the potential drug-drug interactions for tocilizumab and anticoagulant treatments.

### **METHOD**

We report a case of mesenteric arterial thrombosis (MAT) associated with tocilizumab. We searched for other case reports in the WHO global individual case safety report (ICSR) database, VigiBase (high-level terms = Gastrointestinal vascular occlusion and infarction, according to MedDRA).

### **RESULTS**

A 52 year-old woman with RA, obesity, hypertension, hyperlipidemia and atrial fibrillation (AF) presented with abdominal pain. She was included 10 months before the event in a clinical trial evaluating subcutaneous tocilizumab 162 mg weekly. A mesenteric ischemia with superior MAT was diagnosed and an urgent surgical treatment was done. The patient died the following day from a refractory cardiogenic shock. We identified two other reports of MAT with tocilizumab in the VigiBase, both associated with an anticoagulant treatment (warfarine or rivaroxaban). Ten other cases were identified, for which anticoagulant treatment was not specified.

### **CONCLUSION**

Among 13 cases of gastrointestinal vascular events with tocilizumab, three were associated with a previous anticoagulant treatment. Considering the rarity of MAT, the question arises of a possible interaction tocilizumab-anticoagulant. IL-6 inhibits expression of CYP450 and treatment with tocilizumab can restore CYP450 metabolism. Our case, occurring with dabigatran, suggests a possible interaction with P-gp. Therefore a specific attention is necessary when TCZ is introduced in patients under anticoagulant treatments not only for those metabolized by CYP450 but also for those whose absorption/excretion involves P-gp.

1 Tocilizumab (TCZ) is a humanized monoclonal antibody directed against the interleukin-6 (IL-  
2 6) receptor. We herein report one case of mesenteric arterial thrombosis (MAT), in a  
3 rheumatoid arthritis (RA) patient receiving TCZ. In August 2015, a 52 year-old woman  
4 presented to emergency room with acute epigastric pain.. Her medical history included RA  
5 (diagnosed in 2013), obesity, smoking, hypertension, hyperlipidemia, recurrent bronchitis and  
6 atrial fibrillation (AF). RA was initially treated by methotrexate, then by leflunomide and oral  
7 steroids. In October 2014, she initiated subcutaneous TCZ 162 mg weekly. The last injection  
8 was performed in July 2015. Three days before the event, she consulted for pulmonary  
9 symptomatology and was prescribed empiric amoxicillin. Other medications included  
10 dabigatran, flecainide (stopped two weeks earlier), telmisartan/hydrochlorothiazide, atenolol,  
11 furosemide and budesonide/formoterol. On the day of admission, she was afebrile, blood  
12 pressure was 241/137 mmHg, the electrocardiogram found a depressed ST segment, and  
13 blood tests revealed a moderate hepatic cytolysis and an increased high-sensitivity troponin  
14 T. A treatment by nocardipine, enoxaparin, and isosorbide dinitrate was initiated. The day  
15 after, the abdominal pain worsened. CT scan revealed a superior MAT with bowel injury. An  
16 urgent surgical treatment was performed but the patient died few hours after.

17 In the World Health Organization global individual case safety report database, VigiBase™,  
18 we identified two other reports of MAT with TCZ, associated with an anticoagulant treatment  
19 (rivaroxaban and warfarin, respectively). Ten other cases of TCZ-associated intestinal  
20 infarction or ischemia (without more details) were not associated with an anticoagulant  
21 treatment. All these 12 cases were women, mean age was 53 years. Time to onset (stated in  
22 only four cases) varied from 15 days to 21 months; it was 15 days for the case with  
23 rivaroxaban and was not specified for the case with warfarin. Seven fatal outcomes were  
24 reported.

25 In total, we identified three cases of TCZ-associated MAT with a previous anticoagulant  
26 treatment (one for AF, one for deep vein thrombosis and one for an unknown reason). We  
27 suspect a drug-drug interaction which adds to the potential thrombogenic effect of the RA  
28 disease and/or RA treatments. It has been demonstrated that IL-6 reduces the activity of

29 cytochrome P450 isozymes (1). Therefore, the use of TCZ, by decreasing the IL-6-mediated  
30 inhibition of CYP450, can act as an inducer and increases the metabolism of drugs.  
31 Rivaroxaban is a substrate of CYP3A4 and Pgp and warfarine is a substrate of CYP2B6,  
32 CYP2C9, CYP2C19 and CYP3A4. Concomitant use of TCZ could have resulted in  
33 decreased concentration of anticoagulant and favored the occurrence of thrombosis.  
34 Dabigatran etexilate is known for its poor biodisponibility (6.5%) and is a P-glycoprotein (P-  
35 gp) substrate. P-gp affects drug pharmacokinetics by limiting oral absorption and promoting  
36 excretion. In our case, a possible interaction with P-gp is suggested. The observed ratio of  
37 dabigatran  $AUC_{0 \rightarrow \infty}$  (AUCR) and  $C_{max}$  in presence or absence of the P-gP inducer rifampicine  
38 was 0.33 and 0.34, respectively (2). Since IL-6-treated mice displayed a 70% reduction in  
39 protein expression and a 40–70% reduction in the mRNA levels of all P-gp *mdr* isoforms (3),  
40 we can hypothesize that, TCZ's inhibition of IL-6 activity could restore normal P-gp functions  
41 and reduce bioavailability of dabigatran etexilate, as observed with a P-gp inducer.  
42 In conclusion, we can reasonably assume that, in our patient, co-administration of  
43 tocilizumab with dabigatran had induced a progressively decreased anticoagulant effect of  
44 dabigatran etexilate, favouring thrombosis. Attention must be reinforced when TCZ is  
45 introduced in patients under anticoagulant treatments not only for those metabolized by  
46 CYP450 but also for those whose absorption/excretion involves P-gp.

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