ISSN 2307-8960 (online)

World Journal of *Clinical Cases*

World J Clin Cases 2022 March 16; 10(8): 2363-2659

Published by Baishideng Publishing Group Inc

World Journal of Clinical Cases

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Thrice Monthly Volume 10 Number 8 March 16, 2022

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ABOUT COVER

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The *WJCC* is now indexed in Science Citation Index Expanded (also known as SciSearch®), Journal Citation Reports/Science Edition, Scopus, PubMed, and PubMed Central. The 2021 Edition of Journal Citation Reports® cites the 2020 impact factor (IF) for *WJCC* as 1.337; IF without journal self cites: 1.301; 5-year IF: 1.742; Journal Citation Indicator: 0.33; Ranking: 119 among 169 journals in medicine, general and internal; and Quartile category: Q3. The *WJCC*'s CiteScore for 2020 is 0.8 and Scopus CiteScore rank 2020: General Medicine is 493/793.

RESPONSIBLE EDITORS FOR THIS ISSUE

Production Editor: *Hua-Ge Yu*; **Production Department Director:** *Xu Guo*; **Editorial Office Director:** *Jin-Lei Wang*.

NAME OF JOURNAL
World Journal of Clinical Cases

ISSN
ISSN 2307-8960 (online)

LAUNCH DATE
April 16, 2013

FREQUENCY
Thrice Monthly

PUBLICATION DATE
March 16, 2022

World Journal of Clinical Cases

Submit a Manuscript: https://www.f6publishing.com

World J Clin Cases 2022 March 16; 10(8): 2537-2542

DOI: 10.12998/wjcc.v10.i8.2537

ISSN 2307-8960 (online)

CASE REPORT

Idarucizumab reverses dabigatran-induced anticoagulation in treatment of gastric bleeding: A case report

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Specialty type: Geriatrics and gerontology

Provenance and peer review: Unsolicited article; Externally peer reviewed.

Peer-review model: Single blind

Peer-review report's scientific quality classification

Grade A (Excellent): 0
Grade B (Very good): 0
Grade C (Good): C
Grade D (Fair): 0
Grade E (Poor): 0

P-Reviewer: Trifan A

Received: August 15, 2021
Peer-review started: August 15, 2021
First decision: October 20, 2021
Revised: October 30, 2021
Accepted: January 27, 2022
Article in press: January 27, 2022
Published online: March 16, 2022

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Abstract

BACKGROUND

The drug instructions for dabigatran recommend adjusting the dosage to 110 mg twice daily for patients with bleeding risk, and performing at least one renal function test per year for patients with moderate renal impairment. However, owing to chronic insidiously worsening renal insufficiency, dabigatran can still accumulate abnormally, necessitating therapy with idarucizumab to reverse the anticoagulation due to severe erosive gastritis with widespread stomach mucosal bleeding.

CASE SUMMARY

A 76-year-old woman with a history of atrial fibrillation who took dabigatran 110 mg twice daily as directed to lessen the chance of stroke, was transported to the hospital with hematemesis and melena. Laboratory findings revealed severe life-threatening, blood-loss-induced anemia with a hemoglobin (Hb) level of 41.0 g/L and marked coagulation abnormalities with thrombin time (TT) > 180 s, most likely caused by dabigatran-induced metabolic disorder. Aggressive acid suppressive, hemostatic, and blood transfusion therapy resulted in the misconception that the bleeding was controlled, with subsequent rebleeding. Idarucizumab was administered in a timely manner to counteract dabigatran's anticoagulant impact, and 12 h later, TT was determined to be 17.4 s, which was within the normal range. Finally, the patient had no active bleeding signs and laboratory findings showed an Hb level of 104 g/L and TT of 17.7 s.

CONCLUSION

Renal function, coagulation function, and dabigatran concentration should be regularly monitored in older patients. Proton pump inhibitor and dabigatran coadministration is still controversial in preventing upper gastrointestinal tract

bleeding.

Key Words: Idarucizumab; Dabigatran; Gastric bleeding; Atrial fibrillation; Case report

Core Tip: The anticoagulatory effect of dabigatran resolves completely after five half-lives, which is approximately 2.5-3.5 d after the last dose for patients with normal renal function. Thrombin time (TT) is sensitive to the effects of dabigatran and can be prolonged even with trivial amounts of the drug. This patient exhibited persistent bleeding in the normal coagulation test (except for TT), possibly due to the anticoagulatory effects of the drug administered 4 days after the last dose for her renal insufficiency. Therefore, idarucizumab was administered for hemostasis, thus stopping the bleeding. This case highlights the importance of regular monitoring of renal function in older patients.

Citation: Jia Y, Wang SH, Cui NJ, Liu QX, Wang W, Li X, Gu YM, Zhu Y. Idarucizumab reverses dabigatran-induced anticoagulation in treatment of gastric bleeding: A case report. *World J Clin Cases* 2022; 10(8): 2537-2542
URL: https://www.wjgnet.com/2307-8960/full/v10/i8/2537.htm
DOI: https://dx.doi.org/10.12998/wjcc.v10.i8.2537

INTRODUCTION

Dabigatran is an oral direct-acting thrombin inhibitor that was initially approved by the US Food and Drug Administration for the prevention of stroke and systemic embolism caused by nonvalvular atrial fibrillation (AF)[1,2]. It is considered safer and more effective than warfarin and does not require regular coagulation monitoring or dose adjustment, except for those with renal insufficiency (RI), advanced age, and low body weight[3].

However, even long-term dose-adjusted dabigatran therapy in older patients may also increase the risk of major bleeding such as the gastrointestinal (GI) hemorrhage described in this report or cerebral hemorrhage. Idarucizumab was introduced as a dabigatran antidote in December 2015, and its safety and efficacy have been proven in various studies[4]; however, clinical data are still limited, especially in Asians. Here, we report a case of an older Asian woman whose coagulation function was timely and successfully restored by idarucizumab to rescue her from this life-threatening GI bleeding.

CASE PRESENTATION

Chief complaints

On January 26, 2021, a 76-year-old Asian woman was admitted to our hospital with hematemesis and melena, which she had never experienced before and began the previous day.

History of present illness

Four days prior to this reported incident, the patient experienced upper abdominal discomfort and appetite loss without any recognizable precipitating factors.

History of past illness

The patient had a history of AF since 2019, and had been taking dabigatran (110 mg twice daily) to reduce her stroke risk. She had stopped taking dabigatran for at least 4 d before presenting to the hospital. In addition, she had a history of hypertension and coronary atherosclerotic heart disease for > 20 years, type 2 diabetes for > 5 years, and chronic RI (creatinine clearance 30-50 mL/min per 1.73 m^2) for 1 year. The present event occurred > 12 years after she underwent surgery for bladder cancer and 7 years after thyroid nodule surgery.

Personal and family history

The patient had no other disease history and relevant family disease history.

Physical examination

On arrival at the ward, the temperature, heart rate, respiratory rate, and blood pressure of the patient

were 36.3 °C, 90 bpm, 18 breaths/min, and 105/80 mmHg, respectively. Her palpebral conjunctiva and complexion were pale, abdomen was soft, and middle and upper abdomen showed slight tenderness. In addition, the bowel sounds of the patient were 6/min.

Laboratory examinations

The routine blood tests of the patient showed a white blood cell count of 6890/μL and hemoglobin (Hb) level of 41 g/dL. The coagulation function test showed the following results: thrombin time (TT) > 180 s; activated partial thromboplastin time, 36.2 s; and international normalized ratio (INR), 1.20. The biochemical parameters of the patient were as follows: albumin, 34.6 g/L; blood urea nitrogen, 26.96 mmol/L; and serum creatinine, 251.0 μmol/L (Table 1). The tumor markers -fetoprotein, carcinoembryonic antigen, cancer antigen (CA)199, and CA125 were all within the normal range. The ^{13}C urea breath test for detection of *Helicobacter pylori* (*H. pylori*) was negative.

Imaging examinations

Computed tomography of the entire abdomen showed no obvious abnormalities and electrocardiography showed normal sinus rhythm and abnormal ST-T changes. The electronic gastroscopy showed acute erosive gastritis with extensive gastric mucosal bleeding (Figure 1).

FINAL DIAGNOSIS

Acute erosive gastritis with extensive gastric mucosal bleeding was diagnosed using an electronic gastroscope.

TREATMENT

The patient was administered 2 U 400 mL packed red blood cells (PRBCs), a proton-pump inhibitor (PPI), and octreotide intravenously. On day 2, Hb level increased to 67 g/L and the chief complaints were nausea and retching, which appeared to be well controlled; the remaining concern was abnormal coagulation. On the next day, the patient defecated approximately 400 mL black stools with an Hb level, TT, PT and INR of 44 g/L, 121.20 s, 14.2 s, and 1.25, respectively and was immediately administered 2 U PRBCs.

Single doses of idarucizumab (2.5 g) were administered twice *via* intravenous infusion to reverse the effect of dabigatran, and the related commonly encountered adverse reactions such as fever, headache, hypokalemia, and delirium were not observed. Twelve hours later, the TT of the patient was 17.4 s, which was within the normal range. On day 4, she was administered an additional 2 U PRBCs for the third time, without symptoms of hematemesis and melena on the following days.

OUTCOME AND FOLLOW-UP

The patient had no recurrence of AF during hospitalization and her routine stool and occult blood test results were normal. Finally, she was discharged on hospitalization day 14, with Hb level of 104 g/L and TT of 17.7 s.

DISCUSSION

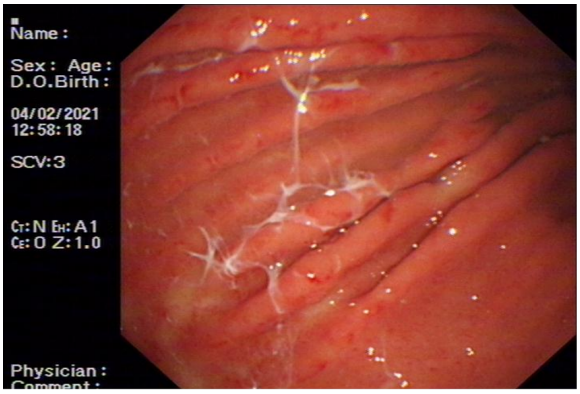
In this study, we presented the case of an older Asian woman whose coagulation function was effectively restored using idarucizumab to reverse the life-threatening GI bleeding experienced following administration of dabigatran. The prodrug of dabigatran, dabigatran etexilate, is rapidly converted to its active form following oral administration. It is an oral non-vitamin K antagonist anticoagulant that acts as a direct reversible and competitive inhibitor of both free and platelet-bound thrombin, thereby affecting the final step of blood clotting[5]. Because of properties such as a short half-life, rapid onset of action, fewer effects on food and drugs, and no INR monitoring requirement[6], dabigatran is deemed a safer and more effective medicine for preventing stroke than some other available agents.

Nevertheless, the elimination of dabigatran is highly dependent on the kidney, through which approximately 85% of plasma dabigatran is excreted, and the process can be prolonged with RI[7]. The RE-LY study demonstrated that dabigatran could reduce all-cause mortality and intracranial hemorrhage, but increased GI bleeding compared with warfarin. The risk of dabigatran-related GI bleeding seems to be evenly distributed between the upper and lower canals (53% *vs* 47%), whereas

Table 1 Laboratory values during hospitalization

Hospital day	Hb (g/L)	TT (s)	PT (s)	APTT (s)	INR	SCr (μmol/L)
Day 1	41	> 180	13.7	36.2	1.20	251
Day 2	67	N/A	N/A	N/A	N/A	N/A
Day 3	44	121.20	14.2	36.3	1.25	229
Day 4	56	17.40	13.1	25.9	1.15	213
Day 5	57	18	12.6	26.0	1.10	202
Day 6	76	N/A	N/A	N/A	N/A	182
Day 8	78	20.90	12.0	28.0	1.04	N/A
Day 10	85	17.70	12.7	29.6	1.11	N/A
Day 14	104	N/A	N/A	N/A	N/A	216

Hb: Hemoglobin (normal concentration: 110-150 g/L); TT: Thrombin time (normal: 14-21 s); PT: Prothrombin time (normal: 9.8-12.7 s); APTT: Activated partial thromboplastin time (normal: 21.1–36.5 s); INR: International normalized ratio (normal: 0.85-1.15); SCr: Serum creatinine (normal: 44-133 μmol/L); N/A: Not available.



DOI: 10.12998/wjcc.v10.i8.2537

Figure 1 Images of esophagogastroduodenoscopy captured on February 4, 2021 showing erosive and contact bleeding of gastric body mucosal surface.

warfarin-related upper canal bleeding dominated (75% *vs* 25%).

The mechanism by which bleeding is induced remains unclear. One possible theory suggests that the local metabolism of dabigatran etexilate increases the concentration of active dabigatran during transit through the GI tract[8,9]. Dabigatran-induced GI hemorrhage is also related to age and primarily occurs in patients aged ≥ 75 years.[10]

H. pylori infection, liver cirrhosis, malignant tumors, genetic factors, history of major bleeding, peptic ulcers, and GI injury such as diverticulosis and intestinal vascular dysplasia can also increase the risk of bleeding[11,12]. A study showed that coadministration of a PPI and dabigatran not only markedly reduced the risk of upper GI hemorrhage, but also the dabigatran plasma levels in patients with AF[13].

In this case report, the patient was a 76-year-old Asian woman with a history of AF and concealed progressive RI. She had undergone long-term dabigatran therapy with dose adjustments for 1 year, regular blood coagulation function monitoring, and oral administration of a PPI. The massive hemorrhage from the gastric mucosa was likely induced by prolonged dabigatran excretion because of RI.

Idarucizumab is a humanized monoclonal antibody that specifically and efficiently inhibits the biological activity of dabigatran etexilate. After antibody-antigen binding, it irreversibly neutralizes the anticoagulant effect. The binding affinity of idarucizumab to dabigatran is 350 times higher than that of dabigatran to thrombin, and the reversal effect shows rapid onset and lasts 12 h, which is suitable for life-threatening bleeding, uncontrolled hemorrhage, or emergency surgery in patients administered dabigatran[14,15]. A single dose of 5 g idarucizumab is reported to be sufficient to reverse the effect of dabigatran etexilate in 98% of patients, and the effect is maintained in most patients for 24 h[16].

Considering the extensive gastric mucosal bleeding experienced by this patient, endoscopic hemostasis was less efficient. The conventional therapeutic regimen of acid suppression, hemostasis,

and blood transfusion did not achieve hemostasis in this patient and idarucizumab was administered to reverse the effect of dabigatran to rescue her from the second episode of life-threatening bleeding. Subsequently, the patient, whose coagulation function was normalized during hospitalization, was relieved of the symptoms of hematemesis and melena, and her Hb level increased to 104 g/L on day 14. Finally, the patient was discharged in stable conditions.

This study had the following limitations and shortcomings that are worth mentioning. (1) The serum level of dabigatran was not measured because of restricted laboratory conditions; (2) Colonoscopy was not performed because we could not obtain informed consent from the patient; and (3) We were unable to detect any possible intracardiac thrombus caused by AF because the transesophageal echocardiography technique was unavailable.

CONCLUSION

We report a case of safe and successful reversal of dabigatran-induced abnormal coagulation function by idarucizumab. In addition, we provide evidence to support recommendations for regular renal and coagulation function tests and dabigatran concentration monitoring for older patients where clinical conditions permit. This is to ensure that proper dose adjustments of dabigatran are instituted or the drug discontinuation is timely if unpredictable blood loss occurs. As mentioned in the discussion regarding dabigatran-induced GI-bleeding-related factors, especially *H. pylori* infection, there is currently no consensus on the benefits of coadministration of PPIs with dabigatran, which warrants further investigation.

ACKNOWLEDGMENTS

We would like to thank the attending physician Zhu Y and deputy chief physician Wang SH for their strong support for the publication of the manuscript.

FOOTNOTES

Author contributions: Jia Y and Zhu Y wrote and modified the manuscript; Wang SH performed the gastroscopy, confirmed the report, and provided the figures; Wang W and Li X collected the data; Cui N participated in the patient treatment; Zhu Y and Liu QX connected us to the pharmaceutical factory and purchased the idarucizumab; Gu YM and Wang SH reviewed the paper and provided suggestions for the revision; all authors have read and approved the final manuscript.

Informed consent statement: All study participants, or their legal guardian, provided informed written consent prior to study enrollment.

Conflict-of-interest statement: We declare that we do not have any commercial or associative interest that represents a conflict of interest in connection with the work submitted.

CARE Checklist (2016) statement: The authors have read the CARE Checklist (2016), and the manuscript was prepared and revised according to the CARE Checklist (2016).

Country/Territory of origin: China

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S-Editor: Wu YXJ
L-Editor: A
P-Editor: Wu YXJ

REFERENCES

1 **Scaglione F**. New oral anticoagulants: comparative pharmacology with vitamin K antagonists. *Clin Pharmacokinet* 2013; **52**: 69-82 [PMID: 23292752 DOI: 10.1007/s40262-012-0030-9]

2 **Greig SL**, McKeage K. Dabigatran etexilate: a review of its use in the treatment of acute venous thromboembolism and prevention of venous thromboembolism recurrence. *Drugs* 2014; **74**: 1785-1800 [PMID: 25270377 DOI: 10.1007/s40265-014-0304-7]

3 **Cardiology Branch of Chinese Medical Association**; Electrophysiology and Pacing Branch of Chinese Medical Association; Professional Committee of Cardiology of Chinese Medical Association. Application of new oral anticoagulants in patients with non-valvular atrial fibrillation-consensus and recommendations from Chinese experts. Chin J Cardiac Arryth 2014; 18: 321-329 [DOI: 10.3760/cma.j.issn.1007-6638.2014.05.001]

4 **Das A**, Liu D. Novel antidotes for target specific oral anticoagulants. *Exp Hematol Oncol* 2015; **4**: 25 [PMID: 26380149 DOI: 10.1186/s40164-015-0020-3]

5 **Eriksson BI**, Quinlan DJ, Weitz JI. Comparative pharmacodynamics and pharmacokinetics of oral direct thrombin and factor xa inhibitors in development. *Clin Pharmacokinet* 2009; **48**: 1-22 [PMID: 19071881 DOI: 10.2165/0003088-200948010-00001]

6 **Hori M**, Connolly SJ, Zhu J, Liu LS, Lau CP, Pais P, Xavier D, Kim SS, Omar R, Dans AL, Tan RS, Chen JH, Tanomsup S, Watanabe M, Koyanagi M, Ezekowitz MD, Reilly PA, Wallentin L, Yusuf S; RE-LY Investigators. Dabigatran *vs* warfarin: effects on ischemic and hemorrhagic strokes and bleeding in Asians and non-Asians with atrial fibrillation. *Stroke* 2013; **44**: 1891-1896 [PMID: 23743976 DOI: 10.1161/STROKEAHA.113.000990]

7 **Stangier J**, Rathgen K, Stähle H, Mazur D. Influence of renal impairment on the pharmacokinetics and pharmacodynamics of oral dabigatran etexilate: an open-label, parallel-group, single-centre study. *Clin Pharmacokinet* 2010; **49**: 259-268 [PMID: 20214409 DOI: 10.2165/11318170-000000000-00000]

8 **Ruff CT**, Giugliano RP, Braunwald E, Hoffman EB, Deenadayalu N, Ezekowitz MD, Camm AJ, Weitz JI, Lewis BS, Parkhomenko A, Yamashita T, Antman EM. Comparison of the efficacy and safety of new oral anticoagulants with warfarin in patients with atrial fibrillation: a meta-analysis of randomised trials. *Lancet* 2014; **383**: 955-962 [PMID: 24315724 DOI: 10.1016/S0140-6736(13)62343-0]

9 **Eikelboom JW**, Wallentin L, Connolly SJ, Ezekowitz M, Healey JS, Oldgren J, Yang S, Alings M, Kaatz S, Hohnloser SH, Diener HC, Franzosi MG, Huber K, Reilly P, Varrone J, Yusuf S. Risk of bleeding with 2 doses of dabigatran compared with warfarin in older and younger patients with atrial fibrillation: an analysis of the randomized evaluation of long-term anticoagulant therapy (RE-LY) trial. *Circulation* 2011; **123**: 2363-2372 [PMID: 21576658 DOI: 10.1161/CIRCULATIONAHA.110.004747]

10 **Romanelli RJ**, Nolting L, Dolginsky M, Kym E, Orrico KB. Dabigatran Versus Warfarin for Atrial Fibrillation in Real-World Clinical Practice: A Systematic Review and Meta-Analysis. *Circ Cardiovasc Qual Outcomes* 2016; **9**: 126-134 [PMID: 26812933 DOI: 10.1161/CIRCOUTCOMES.115.002369]

11 **Kirchhof P**, Benussi S, Kotecha D, Ahlsson A, Atar D, Casadei B, Castella M, Diener HC, Heidbuchel H, Hendriks J, Hindricks G, Manolis AS, Oldgren J, Popescu BA, Schotten U, Van Putte B, Vardas P, Agewall S, Camm J, Baron Esquivias G, Budts W, Carerj S, Casselman F, Coca A, De Caterina R, Deftereos S, Dobrev D, Ferro JM, Filippatos G, Fitzsimons D, Gorenek B, Guenoun M, Hohnloser SH, Kolh P, Lip GY, Manolis A, McMurray J, Ponikowski P, Rosenhek R, Ruschitzka F, Savelieva I, Sharma S, Suwalski P, Tamargo JL, Taylor CJ, Van Gelder IC, Voors AA, Windecker S, Zamorano JL, Zeppenfeld K. 2016 ESC Guidelines for the management of atrial fibrillation developed in collaboration with EACTS. *Europace* 2016; **18**: 1609-1678 [PMID: 27567465 DOI: 10.1093/europace/euw295]

12 **Cheung KS**, Leung WK. Gastrointestinal bleeding in patients on novel oral anticoagulants: Risk, prevention and management. *World J Gastroenterol* 2017; **23**: 1954-1963 [PMID: 28373761 DOI: 10.3748/wjg.v23.i11.1954]

13 **Bolek T**, Samoš M, Škorňová I, Galajda P, Staško J, Kubisz P, Mokáň M. Proton Pump Inhibitors and Dabigatran Therapy: Impact on Gastric Bleeding and Dabigatran Plasma Levels. *Semin Thromb Hemost* 2019; **45**: 846-850 [PMID: 31537027 DOI: 10.1055/s-0039-1695735]

14 **Schiele F**, van Ryn J, Canada K, Newsome C, Sepulveda E, Park J, Nar H, Litzenburger T. A specific antidote for dabigatran: functional and structural characterization. *Blood* 2013; **121**: 3554-3562 [PMID: 23476049 DOI: 10.1182/blood-2012-11-468207]

15 **Pollack CV Jr**, Reilly PA, Eikelboom J, Glund S, Verhamme P, Bernstein RA, Dubiel R, Huisman MV, Hylek EM, Kamphuisen PW, Kreuzer J, Levy JH, Sellke FW, Stangier J, Steiner T, Wang B, Kam CW, Weitz JI. Idarucizumab for Dabigatran Reversal. *N Engl J Med* 2015; **373**: 511-520 [PMID: 26095746 DOI: 10.1056/NEJMoa1502000]

16 **Pollack CV Jr**, Reilly PA, van Ryn J, Eikelboom JW, Glund S, Bernstein RA, Dubiel R, Huisman MV, Hylek EM, Kam CW, Kamphuisen PW, Kreuzer J, Levy JH, Royle G, Sellke FW, Stangier J, Steiner T, Verhamme P, Wang B, Young L, Weitz JI. Idarucizumab for Dabigatran Reversal - Full Cohort Analysis. *N Engl J Med* 2017; **377**: 431-441 [PMID: 28693366 DOI: 10.1056/NEJMoa1707278]

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