

# World Journal of *Clinical Cases*

*World J Clin Cases* 2021 November 16; 9(32): 9699-10051



**REVIEW**

- 9699 Emerging role of long noncoding RNAs in recurrent hepatocellular carcinoma  
*Fang Y, Yang Y, Li N, Zhang XL, Huang HF*

**MINIREVIEWS**

- 9711 Current treatment strategies for patients with only peritoneal cytology positive stage IV gastric cancer  
*Bausys A, Gricius Z, Aniuksyte L, Luksta M, Bickaite K, Bausys R, Strupas K*

**ORIGINAL ARTICLE****Case Control Study**

- 9722 Botulinum toxin associated with fissurectomy and anoplasty for hypertonic chronic anal fissure: A case-control study  
*D'Orazio B, Geraci G, Famà F, Terranova G, Di Vita G*
- 9731 Correlation between circulating endothelial cell level and acute respiratory distress syndrome in postoperative patients  
*Peng M, Yan QH, Gao Y, Zhang Z, Zhang Y, Wang YF, Wu HN*

**Retrospective Study**

- 9741 Effects of early rehabilitation in improvement of paediatric burnt hands function  
*Zhou YQ, Zhou JY, Luo GX, Tan JL*
- 9752 Intracortical screw insertion plus limited open reduction in treating type 31A3 irreducible intertrochanteric fractures in the elderly  
*Huang XW, Hong GQ, Zuo Q, Chen Q*
- 9762 Treatment effects and periodontal status of chronic periodontitis after routine Er:YAG laser-assisted therapy  
*Gao YZ, Li Y, Chen SS, Feng B, Wang H, Wang Q*
- 9770 Risk factors for occult metastasis detected by inflammation-based prognostic scores and tumor markers in biliary tract cancer  
*Hashimoto Y, Ajiki T, Yanagimoto H, Tsugawa D, Shinozaki K, Toyama H, Kido M, Fukumoto T*
- 9783 Scapular bone grafting with allograft pin fixation for repair of bony Bankart lesions: A biomechanical study  
*Lu M, Li HP, Liu YJ, Shen XZ, Gao F, Hu B, Liu YF*
- 9792 High-resolution computed tomography findings independently predict epidermal growth factor receptor mutation status in ground-glass nodular lung adenocarcinoma  
*Zhu P, Xu XJ, Zhang MM, Fan SF*

- 9804** Colorectal cancer patients in a tertiary hospital in Indonesia: Prevalence of the younger population and associated factors

*Makmun D, Simadibrata M, Abdullah M, Syam AF, Shatri H, Fauzi A, Renaldi K, Maulahela H, Utari AP, Pribadi RR, Muzellina VN, Nursyirwan SA*

- 9815** Association between *Helicobacter pylori* infection and food-specific immunoglobulin G in Southwest China

*Liu Y, Shuai P, Liu YP, Li DY*

- 9825** Systemic immune inflammation index, ratio of lymphocytes to monocytes, lactate dehydrogenase and prognosis of diffuse large B-cell lymphoma patients

*Wu XB, Hou SL, Liu H*

### Clinical Trials Study

- 9835** Evaluating the efficacy of endoscopic sphincterotomy on biliary-type sphincter of Oddi dysfunction: A retrospective clinical trial

*Ren LK, Cai ZY, Ran X, Yang NH, Li XZ, Liu H, Wu CW, Zeng WY, Han M*

### Observational Study

- 9847** Management of pouch related symptoms in patients who underwent ileal pouch anal anastomosis surgery for adenomatous polyposis

*Gilad O, Rosner G, Brazowski E, Kariv R, Gluck N, Strul H*

- 9857** Presepsin as a biomarker for risk stratification for acute cholangitis in emergency department: A single-center study

*Zhang HY, Lu ZQ, Wang GX, Xie MR, Li CS*

### Prospective Study

- 9869** Efficacy of Yiqi Jianpi anti-cancer prescription combined with chemotherapy in patients with colorectal cancer after operation

*Li Z, Yin DF, Wang W, Zhang XW, Zhou LJ, Yang J*

### META-ANALYSIS

- 9878** Arthroplasty *vs* proximal femoral nails for unstable intertrochanteric femoral fractures in elderly patients: a systematic review and meta-analysis

*Chen WH, Guo WX, Gao SH, Wei QS, Li ZQ, He W*

### CASE REPORT

- 9889** Synchronous multiple primary malignancies of the esophagus, stomach, and jejunum: A case report

*Li Y, Ye LS, Hu B*

- 9896** Idiopathic acute superior mesenteric venous thrombosis after renal transplantation: A case report

*Zhang P, Li XJ, Guo RM, Hu KP, Xu SL, Liu B, Wang QL*

- 9903** Next-generation sequencing technology for diagnosis and efficacy evaluation of a patient with visceral leishmaniasis: A case report

*Lin ZN, Sun YC, Wang JP, Lai YL, Sheng LX*

- 9911** Cerebral air embolism complicating transbronchial lung biopsy: A case report  
*Herout V, Brat K, Richter S, Cundrle Jr I*
- 9917** Isolated synchronous Virchow lymph node metastasis of sigmoid cancer: A case report  
*Yang JQ, Shang L, Li LP, Jing HY, Dong KD, Jiao J, Ye CS, Ren HC, Xu QF, Huang P, Liu J*
- 9926** Clinical presentation and management of drug-induced gingival overgrowth: A case series  
*Fang L, Tan BC*
- 9935** Adult with mass burnt lime aspiration: A case report and literature review  
*Li XY, Hou HJ, Dai B, Tan W, Zhao HW*
- 9942** Massive hemothorax due to intercostal arterial bleeding after percutaneous catheter removal in a multiple-trauma patient: A case report  
*Park C, Lee J*
- 9948** Hemolymphangioma with multiple hemangiomas in liver of elderly woman with history of gynecological malignancy: A case report  
*Wang M, Liu HF, Zhang YZZ, Zou ZQ, Wu ZQ*
- 9954** Rare location and drainage pattern of right pulmonary veins and aberrant right upper lobe bronchial branch: A case report  
*Wang FQ, Zhang R, Zhang HL, Mo YH, Zheng Y, Qiu GH, Wang Y*
- 9960** Respiratory failure after scoliosis correction surgery in patients with Prader-Willi syndrome: Two case reports  
*Yoon JY, Park SH, Won YH*
- 9970** Computed tomography-guided chemical renal sympathetic nerve modulation in the treatment of resistant hypertension: A case report  
*Luo G, Zhu JJ, Yao M, Xie KY*
- 9977** Large focal nodular hyperplasia is unresponsive to arterial embolization: A case report  
*Ren H, Gao YJ, Ma XM, Zhou ST*
- 9982** Fine-needle aspiration cytology of an intrathyroidal nodule diagnosed as squamous cell carcinoma: A case report  
*Yu JY, Zhang Y, Wang Z*
- 9990** Extensive abdominal lymphangiomatosis involving the small bowel mesentery: A case report  
*Alhasan AS, Daqqaq TS*
- 9997** Gastrointestinal symptoms as the first sign of chronic granulomatous disease in a neonate: A case report  
*Meng EY, Wang ZM, Lei B, Shang LH*
- 10006** Screw penetration of the iliopsoas muscle causing late-onset pain after total hip arthroplasty: A case report  
*Park HS, Lee SH, Cho HM, Choi HB, Jo S*

- 10013** Uretero-lumbar artery fistula: A case report  
*Chen JJ, Wang J, Zheng QG, Sun ZH, Li JC, Xu ZL, Huang XJ*
- 10018** Rare mutation in *MKRN3* in two twin sisters with central precocious puberty: Two case reports  
*Jiang LQ, Zhou YQ, Yuan K, Zhu JF, Fang YL, Wang CL*
- 10024** Primary mucosal-associated lymphoid tissue extranodal marginal zone lymphoma of the bladder from an imaging perspective: A case report  
*Jiang ZZ, Zheng YY, Hou CL, Liu XT*
- 10033** Focal intramural hematoma as a potential pitfall for iatrogenic aortic dissection during subclavian artery stenting: A case report  
*Zhang Y, Wang JW, Jin G, Liang B, Li X, Yang YT, Zhan QL*
- 10040** Ventricular tachycardia originating from the His bundle: A case report  
*Zhang LY, Dong SJ, Yu HJ, Chu YJ*
- 10046** Posthepatectomy jaundice induced by paroxysmal nocturnal hemoglobinuria: A case report  
*Liang HY, Xie XD, Jing GX, Wang M, Yu Y, Cui JF*

**ABOUT COVER**

Editorial Board Member of *World Journal of Clinical Cases*, Jalaj Garg, FACC, MD, Academic Research, Assistant Professor, Division of Cardiology, Medical College of Wisconsin, Milwaukee, WI 53226, United States.  
garg.jalaj@yahoo.com

**AIMS AND SCOPE**

The primary aim of *World Journal of Clinical Cases (WJCC, World J Clin Cases)* is to provide scholars and readers from various fields of clinical medicine with a platform to publish high-quality clinical research articles and communicate their research findings online.

*WJCC* mainly publishes articles reporting research results and findings obtained in the field of clinical medicine and covering a wide range of topics, including case control studies, retrospective cohort studies, retrospective studies, clinical trials studies, observational studies, prospective studies, randomized controlled trials, randomized clinical trials, systematic reviews, meta-analysis, and case reports.

**INDEXING/ABSTRACTING**

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: Jia-Hui Li; Production Department Director: Yu-Jie Ma; Editorial Office Director: Jin-Lai Wang.

**NAME OF JOURNAL**

*World Journal of Clinical Cases*

**ISSN**

ISSN 2307-8960 (online)

**LAUNCH DATE**

April 16, 2013

**FREQUENCY**

Thrice Monthly

**EDITORS-IN-CHIEF**

Dennis A Bloomfield, Sandro Vento, Bao-Gan Peng

**EDITORIAL BOARD MEMBERS**

<https://www.wjgnet.com/2307-8960/editorialboard.htm>

**PUBLICATION DATE**

November 16, 2021

**COPYRIGHT**

© 2021 Baishideng Publishing Group Inc

**INSTRUCTIONS TO AUTHORS**

<https://www.wjgnet.com/bpg/gerinfo/204>

**GUIDELINES FOR ETHICS DOCUMENTS**

<https://www.wjgnet.com/bpg/GerInfo/287>

**GUIDELINES FOR NON-NATIVE SPEAKERS OF ENGLISH**

<https://www.wjgnet.com/bpg/gerinfo/240>

**PUBLICATION ETHICS**

<https://www.wjgnet.com/bpg/GerInfo/288>

**PUBLICATION MISCONDUCT**

<https://www.wjgnet.com/bpg/gerinfo/208>

**ARTICLE PROCESSING CHARGE**

<https://www.wjgnet.com/bpg/gerinfo/242>

**STEPS FOR SUBMITTING MANUSCRIPTS**

<https://www.wjgnet.com/bpg/GerInfo/239>

**ONLINE SUBMISSION**

<https://www.f6publishing.com>

## Posthepatectomy jaundice induced by paroxysmal nocturnal hemoglobinuria: A case report

Hong-Yin Liang, Xiao-Dong Xie, Guang-Xu Jing, Meng Wang, Yang Yu, Jian-Feng Cui

**ORCID number:** Hong-Yin Liang 0000-0002-1893-2936; Xiao-Dong Xie 0000-0001-5868-6816; Guang-Xu Jing 0000-0002-3555-7795; Meng Wang 0000-0003-3455-547X; Yang Yu 0000-0002-1356-3801; Jian-Feng Cui 0000-0002-1878-1197.

**Author contributions:** Liang HY wrote the manuscript; Xie XD, Wang M, and Yu Y collected the data and drew the diagram; Jiang GX contributed to citations and references; Cui JF contributed to the discussion and revision; all authors issued final approval for the version to be submitted.

**Informed consent statement:** Informed written consent was obtained from the patient for publication of this report and any accompanying images.

**Conflict-of-interest statement:** The authors declare that they have no conflict of interest.

**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).

**Open-Access:** This article is an open-access article that was selected by an in-house editor and fully peer-reviewed by external reviewers. It is distributed in

Hong-Yin Liang, Xiao-Dong Xie, Jian-Feng Cui, Department of General Surgery, General Hospital of Western Theater Command, Chengdu 410000, Sichuan Province, China

Guang-Xu Jing, The Southwest Medical University, Luzhou 410000, Sichuan Province, China

Meng Wang, Department of Traditional Chinese Medicine, General Hospital of Western Theater Command, Chengdu 410000, Sichuan Province, China

Yang Yu, Department of Medical Examination, General Hospital of Western Theater Command, Chengdu 410000, Sichuan Province, China

**Corresponding author:** Jian-Feng Cui, MD, Professor, Department of General Surgery, General Hospital of Western Theater Command, No. 260 Rongdu Avenue, Jinniu District, Chengdu 410000, Sichuan Province, China. [cjfabear@126.com](mailto:cjfabear@126.com)

### Abstract

#### BACKGROUND

Jaundice is a major manifestation of posthepatectomy liver failure, a feared complication after hepatic resection. Herein, we report a case of posthepatectomy jaundice that was not caused by liver failure but by paroxysmal nocturnal hemoglobinuria (PNH)-induced hemolysis.

#### CASE SUMMARY

A 56-year-old woman underwent right hepatectomy and biliary tract exploration surgery due to hepatic duct stones. Prior to surgery, the patient was mildly anemic. The direct antiglobulin test was negative. A bone marrow biopsy showed mild histiocyte hyperplasia. After surgery, the patient suffered a progressive increase in serum bilirubin. Meanwhile, the patient developed hemolytic symptoms after blood transfusion. She was ultimately diagnosed with PNH. PNH is a rare bone marrow failure disorder that manifests as complement-dependent intravascular hemolysis with varying severity. After steroid treatment, the patient's jaundice gradually decreased, and the patient was discharged on the 35<sup>th</sup> postoperative day.

#### CONCLUSION

PNH-induced hemolysis is a rare cause of posthepatectomy jaundice. It should be suspected in patients having posthepatectomy hyperbilirubinemia without other signs of liver failure. Steroid therapy can be considered for the treatment of PNH in such cases.

accordance with the Creative Commons Attribution NonCommercial (CC BY-NC 4.0) license, which permits others to distribute, remix, adapt, build upon this work non-commercially, and license their derivative works on different terms, provided the original work is properly cited and the use is non-commercial. See: <http://creativecommons.org/licenses/by-nc/4.0/>

**Specialty type:** Surgery

**Country/Territory of origin:** China

**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

**Received:** August 12, 2021

**Peer-review started:** August 12, 2021

**First decision:** September 2, 2021

**Revised:** September 8, 2021

**Accepted:** September 22, 2021

**Article in press:** September 22, 2021

**Published online:** November 16, 2021

**P-Reviewer:** Kamiyama T

**S-Editor:** Wang JL

**L-Editor:** A

**P-Editor:** Li JH



**Key Words:** Jaundice; Hepatectomy; Paroxysmal nocturnal hemoglobinuria; Case report

©The Author(s) 2021. Published by Baishideng Publishing Group Inc. All rights reserved.

**Core Tip:** We report a case of posthepatectomy jaundice that was not caused by liver failure but by paroxysmal nocturnal hemoglobinuria-induced hemolysis. After confirming the diagnosis, the patient received steroid therapy, and the jaundice gradually improved.

**Citation:** Liang HY, Xie XD, Jing GX, Wang M, Yu Y, Cui JF. Posthepatectomy jaundice induced by paroxysmal nocturnal hemoglobinuria: A case report. *World J Clin Cases* 2021; 9(32): 10046-10051

**URL:** <https://www.wjgnet.com/2307-8960/full/v9/i32/10046.htm>

**DOI:** <https://dx.doi.org/10.12998/wjcc.v9.i32.10046>

## INTRODUCTION

Although the safety of liver resection has improved with advanced operative techniques and perioperative management, posthepatectomy liver failure (PHLF) remains a challenge for patients undergoing hepatectomy and a concern of hepatic surgeons[1]. Postoperative hyperbilirubinemia and an increased international normalized ratio (INR) are the major manifestations of PHLF according to the definition of the International Study Group of Liver Surgery[2]. Herein, we report a case of posthepatectomy jaundice that was not caused by PHLF but by paroxysmal nocturnal hemoglobinuria (PNH)-induced hemolysis. There have been no previous reports of posthepatectomy jaundice caused by PNH.

## CASE PRESENTATION

### Chief complaints

The subject was a 56-year-old female with a chief complaint of abdominal pain and fever.

### History of present illness

Ten days before admission, the patient visited a local hospital for acute right upper quadrant abdominal pain. The pain was moderate, tolerable, and persistent. Additionally, the patient suffered from fever, with a temperature of up to 39 degrees Celsius. She did not complain of vomiting or diarrhea. An abdominal ultrasound revealed bile duct stones. After cefoperazone anti-infection treatment, the patient's symptoms were relieved, and the patient was transferred to our hospital.

### History of past illness

The patient had undergone cholecystectomy for gallbladder stones 20 years prior to presentation at our hospital.

### Personal and family history

The patient had a previous history of mild anemia and did not have a remarkable family medical history.

### Physical examination

On physical examination, the patient was conscious and cooperative. The abdominal region was flat and soft.

### Laboratory examinations

The patient's preoperative laboratory examinations were only mildly abnormal: Hemoglobin (Hgb) 91 g/L, white blood cell count, 9800/ $\mu$ L; platelet count,  $107 \times 10^9$

/L; total bilirubin (TBIL), 58.6  $\mu\text{mol/L}$ ; direct bilirubin (DBIL), 35.3  $\mu\text{mol/L}$ ; aspartate aminotransferase (AST), 33.5 U/L; albumin, 38.7 g/L; C-reactive protein, 32.4 mg/dL; prothrombin time, 10.8 s; INR, 0.98; indocyanine green retention rate at 15 min, 5.5%. The result of direct antiglobulin test was negative, and bone marrow biopsy showed mild histiocyte hyperplasia.

### **Imaging examinations**

Magnetic resonance imaging revealed right intrahepatic bile duct stones and common bile duct stones (Figure 1). The future liver remnant was 49%.

---

## **FINAL DIAGNOSIS**

The patient was diagnosed with hepatolithiasis and choledocholithiasis. After surgery, she was diagnosed to have PNH induced hemolysis causing postoperative jaundice.

---

## **TREATMENT**

Open surgery was performed after the preoperative examinations were completed. Intraoperative ultrasonography reconfirmed that the right intrahepatic bile duct was extensively dilated with stones. The common bile duct was approximately 1.4 cm. Eventually, right hepatectomy and biliary tract exploration with intraoperative choledochoscopic lithotripsy, without hepaticojejunostomy, were conducted. The operation proceeded successfully without a requirement for blood transfusion. The operating time was 250 min, and the estimated blood loss was less than 100 mL.

An artificial liver support system was required on the 8th and 11th postoperative days due to hyperbilirubinemia. The patient received a blood transfusion (erythrocyte suspensions, 3 U; and plasma, 400 mL) because of a decrease in Hgb to 65 g/L on the 12<sup>th</sup> postoperative day.

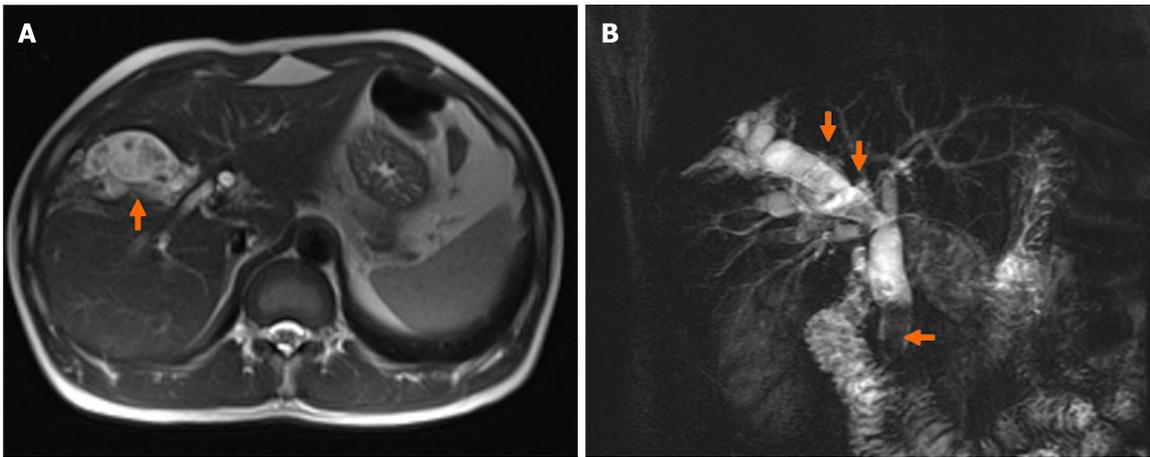
The patient was treated with steroids after the diagnosis of postoperative jaundice caused by PNH induced hemolysis was made. The treatment protocol is shown in Figure 2. On postoperative day 14, the patient started steroid treatment with methylprednisolone at a dose of 2.0 mg/kg/d. The patient's jaundice gradually stabilized. The dose of methylprednisolone was reduced to 1.5 mg/kg/d after 1 wk, 1.0 mg/kg/d after 2 wk, 0.75 mg/kg/d after 3 wk, and 0.5 mg/kg/d after 4 wk. The dose of 0.5 mg/kg/d was maintained for 4 wk, and 0.25 mg/kg/d was maintained for an additional 4 wk.

---

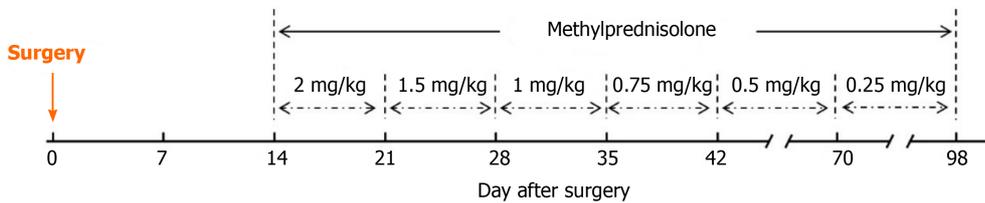
## **OUTCOME AND FOLLOW-UP**

After surgery, the patient suffered a progressive increase in serum bilirubin (Figure 3A). Paradoxically, the AST and INR were mildly elevated postoperatively and declined gradually (Figure 3B). Postoperative ultrasound did not reveal intra- or extrahepatic bile duct dilatation. These results did not resemble the typical presentation of PHLF. During this time, the patient presented with low back pain and hemoglobinuria after the blood transfusion. Hemolytic screening was subsequently implemented. The direct antiglobulin test was repeated, and the result was still negative. The serum-free Hgb was elevated to 117 mg/L. The results of the glucose-6-phosphate dehydrogenase test and erythrocyte osmotic fragility test were negative. The flow cytometry analysis showed that CD59 was absent on the 27% of erythrocytes surface. Flow cytometry to detect populations of CD55 or CD59 deficient blood cells is firmly established as the method of choice for the diagnosis and monitoring of PNH. Thus, this patient's postoperative hyperbilirubinemia was confirmed to be caused by PNH-induced hemolysis.

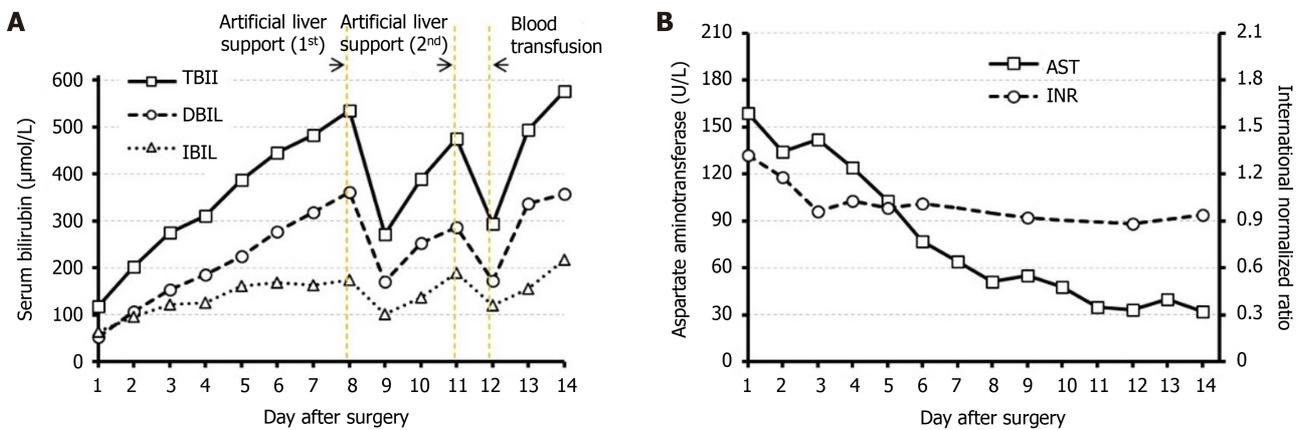
The patient's jaundice gradually improved after steroid treatment (Figure 4). The patient was discharged on the 35<sup>th</sup> postoperative day. At discharge, the TBIL of the patient had decreased to 198.3  $\mu\text{mol/L}$ . When followed up at 6 mo after surgery, the patient's Hgb was 85 g/L, and TBIL was 48.3  $\mu\text{mol/L}$ .



**Figure 1** Preoperative magnetic resonance imaging of the patient. A: Cross-section; B: Magnetic resonance cholangiopancreatography. The right intrahepatic bile duct stones and common bile duct stones are presented (arrows).



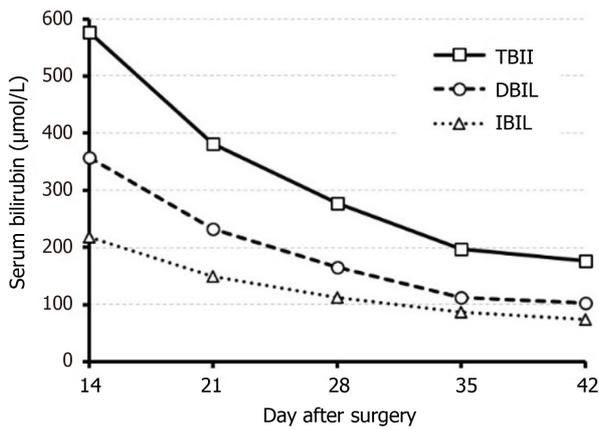
**Figure 2** The steroid treatment protocol of the patient during hospitalization.



**Figure 3** Hematological indices of the patient during the first 14 postoperative days. A: Serum bilirubin; B: Aspartate aminotransferase and international normalized ratio. TBIL: Total bilirubin; DBIL: Direct bilirubin; IBIL: Indirect bilirubin; AST: Aspartate aminotransferase; and INR: International normalized ratio.

## DISCUSSION

PNH is a rare and acquired hematopoietic stem cell disorder that is characterized by the destruction of blood cells *via* the complement system due to a deficiency of glycosylphosphatidylinositol-anchored proteins (GPI-APs), such as CD55 and CD59, on the blood cell surface, resulting in symptoms such as hemoglobinuria[3]. For the diagnosis of PNH, flow cytometry is recommended to identify a deficiency of GPI-APs in peripheral blood cells[4,5]. In this patient, CD59 absence on the surface of 27% of erythrocytes was an important factor in the diagnosis of PNH. In terms of treatment, complement inhibition therapy in the form of eculizumab has improved treatment prospects for PNH patients in developed countries[6,7]. However, high costs and access difficulties have limited the utilization of eculizumab in China, and steroid therapy is still the preferred treatment to control hemolytic attacks in PNH patients[8].



**Figure 4** Serum bilirubin of the patient on postoperative days 14 to 42. TBIL: Total bilirubin; DBIL: Direct bilirubin; IBIL: Indirect bilirubin.

In this case, the patient's hyperbilirubinemia was relieved after the administration of methylprednisolone, and the treatment achieved relatively favorable outcomes.

There were several points that deserve our attention in this case.

First, the severity of hemolysis varies in PNH patients. There are some PNH patients with insidious onset that have no characteristic manifestations[9]. This patient only presented with mild anemia and elevated bilirubin preoperatively, which is also common in patients with bile duct stones. Moreover, the preoperative bone marrow biopsy showed no significant abnormalities. The patient was not diagnosed with PNH until hemolytic symptoms developed after blood transfusion.

Second, in this patient, it is possible that transfusion of plasma, rather than erythrocyte suspension, aggravated the patient's hemolysis. PNH may induce complement-dependent intravascular hemolysis[10]. Plasma transfusion might replenish the depleted complement, thus exacerbating the occurrence of hemolysis in PNH erythrocytes. Although the use of washed red blood cells for transfusion in PNH patients has been recommended previously, recent studies have found that transfusion of homozygous red blood cells does not significantly increase the occurrence of hemolysis in PNH patients[11].

Third, it has been reported that chronic hemolysis may lead to increased bilirubin excretion, resulting in an increased incidence of hepatobiliary stones[12]. Therefore, theoretically, PNH patients have a higher chance of hepatobiliary stones. There have been reports of cholecystectomy in patients with PNH[13], but there have been no reports of hepatectomy in patients with PNH. Surgery may be one of the clinical conditions that triggers PNH-induced hemolysis[14]. Perisurgical induction of eculizumab has been reported in a patient with PNH to inhibit surgery-triggered hemolysis[13,15].

Last, the jaundice caused by hemolysis typically features elevated indirect bilirubin (IBIL)[16]. However, the postoperative DBIL elevation was more significant in this patient. The liver is the main metabolic site for bilirubin. The IBIL produced by hemolysis is transported to hepatocytes and combined with glucuronide to form DBIL, which is subsequently excreted into the bile ducts[17]. Right hemicolectomy may lead to a reduction in liver size and a decrease in the liver's ability to metabolize and excrete bilirubin. In the event of increased IBIL production from hemolysis, it is possible that the residual hepatic capacity to metabolize DBIL is greater than the hepatic capacity to excrete DBIL. This has not been reported in previous reports and may need to be validated in further animal experiments.

## CONCLUSION

PNH-induced hemolysis is a rare cause of posthepatectomy jaundice. It should be suspected in patients having posthepatectomy hyperbilirubinemia without other signs of liver failure. Steroid therapy can be considered for the treatment of PNH in such cases.

## REFERENCES

- 1 **Søreide JA**, Deshpande R. Post hepatectomy liver failure (PHLF) - Recent advances in prevention and clinical management. *Eur J Surg Oncol* 2021; **47**: 216-224 [PMID: [32943278](#) DOI: [10.1016/j.ejso.2020.09.001](#)]
- 2 **Rahbari NN**, Garden OJ, Padbury R, Brooke-Smith M, Crawford M, Adam R, Koch M, Makuuchi M, Dematteo RP, Christophi C, Banting S, Usatoff V, Nagino M, Maddern G, Hugh TJ, Vauthey JN, Greig P, Rees M, Yokoyama Y, Fan ST, Nimura Y, Figueras J, Capussotti L, Büchler MW, Weitz J. Posthepatectomy liver failure: a definition and grading by the International Study Group of Liver Surgery (ISGLS). *Surgery* 2011; **149**: 713-724 [PMID: [21236455](#) DOI: [10.1016/j.surg.2010.10.001](#)]
- 3 **Devalet B**, Mullier F, Chatelain B, Dogné JM, Chatelain C. Pathophysiology, diagnosis, and treatment of paroxysmal nocturnal hemoglobinuria: a review. *Eur J Haematol* 2015; **95**: 190-198 [PMID: [25753400](#) DOI: [10.1111/ejh.12543](#)]
- 4 **Parker C**, Omine M, Richards S, Nishimura J, Bessler M, Ware R, Hillmen P, Luzzatto L, Young N, Kinoshita T, Rosse W, Socié G; International PNH Interest Group. Diagnosis and management of paroxysmal nocturnal hemoglobinuria. *Blood* 2005; **106**: 3699-3709 [PMID: [16051736](#) DOI: [10.1182/blood-2005-04-1717](#)]
- 5 **Parker CJ**. Update on the diagnosis and management of paroxysmal nocturnal hemoglobinuria. *Hematology Am Soc Hematol Educ Program* 2016; **2016**: 208-216 [PMID: [27913482](#) DOI: [10.1182/asheducation-2016.1.208](#)]
- 6 **Hillmen P**, Young NS, Schubert J, Brodsky RA, Socié G, Muus P, Röth A, Szer J, Elebute MO, Nakamura R, Browne P, Risitano AM, Hill A, Schrezenmeier H, Fu CL, Maciejewski J, Rollins SA, Mojcik CF, Rother RP, Luzzatto L. The complement inhibitor eculizumab in paroxysmal nocturnal hemoglobinuria. *N Engl J Med* 2006; **355**: 1233-1243 [PMID: [16990386](#) DOI: [10.1056/NEJMoa061648](#)]
- 7 **Loschi M**, Porcher R, Barraco F, Terriou L, Mohty M, de Guibert S, Mahe B, Lemal R, Dumas PY, Etienne G, Jardin F, Royer B, Bordessoule D, Rohrlrich PS, Fornecker LM, Salanoubat C, Maury S, Cahn JY, Vincent L, Sene T, Rigaudeau S, Nguyen S, Lepretre AC, Mary JY, Corront B, Socié G, Peffault de Latour R. Impact of eculizumab treatment on paroxysmal nocturnal hemoglobinuria: a treatment vs no-treatment study. *Am J Hematol* 2016; **91**: 366-370 [PMID: [26689746](#) DOI: [10.1002/ajh.24278](#)]
- 8 **Fu R**, Li L, Liu H, Zhang T, Ding S, Wang G, Song J, Wang H, Xing L, Guan J, Shao Z. Analysis of clinical characteristics of 92 patients with paroxysmal nocturnal hemoglobinuria: A single institution experience in China. *J Clin Lab Anal* 2020; **34**: e23008 [PMID: [31502726](#) DOI: [10.1002/jcla.23008](#)]
- 9 **Brodsky RA**. Paroxysmal nocturnal hemoglobinuria. *Blood* 2014; **124**: 2804-2811 [PMID: [25237200](#) DOI: [10.1182/blood-2014-02-522128](#)]
- 10 **Merrill SA**, Brodsky RA. Complement-driven anemia: more than just paroxysmal nocturnal hemoglobinuria. *Hematology Am Soc Hematol Educ Program* 2018; **2018**: 371-376 [PMID: [30504334](#) DOI: [10.1182/asheducation-2018.1.371](#)]
- 11 **Brecher ME**, Taswell HF. Paroxysmal nocturnal hemoglobinuria and the transfusion of washed red cells. A myth revisited. *Transfusion* 1989; **29**: 681-685 [PMID: [2799892](#) DOI: [10.1046/j.1537-2995.1989.29890020439.x](#)]
- 12 **Ebert EC**, Nagar M, Hagspiel KD. Gastrointestinal and hepatic complications of sickle cell disease. *Clin Gastroenterol Hepatol* 2010; **8**: 483-9; quiz e70 [PMID: [20215064](#) DOI: [10.1016/j.cgh.2010.02.016](#)]
- 13 **Ando K**, Gotoh A, Yoshizawa S, Gotoh M, Iwabuchi T, Ito Y, Ohyashiki K. Successful cholecystectomy in a patient with aplastic anemia-paroxysmal nocturnal hemoglobinuria during eculizumab treatment. *Ann Hematol* 2012; **91**: 1987-1988 [PMID: [22739575](#) DOI: [10.1007/s00277-012-1514-2](#)]
- 14 **Kurita N**, Obara N, Fukuda K, Nishikii H, Sato S, Inagawa S, Kurokawa T, Owada Y, Ninomiya H, Chiba S. Perisurgical induction of eculizumab in a patient with paroxysmal nocturnal hemoglobinuria: its inhibition of surgery-triggered hemolysis and the consequence of subsequent discontinuation. *Blood Coagul Fibrinolysis* 2013; **24**: 658-662 [PMID: [23917586](#) DOI: [10.1097/MBC.0b013e328360d057](#)]
- 15 **Parker CJ**. Management of paroxysmal nocturnal hemoglobinuria in the era of complement inhibitory therapy. *Hematology Am Soc Hematol Educ Program* 2011; **2011**: 21-29 [PMID: [22160008](#) DOI: [10.1182/asheducation-2011.1.21](#)]
- 16 **Rifkind JM**, Nagababu E. Hemoglobin redox reactions and red blood cell aging. *Antioxid Redox Signal* 2013; **18**: 2274-2283 [PMID: [23025272](#) DOI: [10.1089/ars.2012.4867](#)]
- 17 **Kosmachevskaya OV**, Topunov AF. Alternate and Additional Functions of Erythrocyte Hemoglobin. *Biochemistry (Mosc)* 2018; **83**: 1575-1593 [PMID: [30878032](#) DOI: [10.1134/S0006297918120155](#)]



Published by **Baishideng Publishing Group Inc**  
7041 Koll Center Parkway, Suite 160, Pleasanton, CA 94566, USA  
**Telephone:** +1-925-3991568  
**E-mail:** [bpgoffice@wjgnet.com](mailto:bpgoffice@wjgnet.com)  
**Help Desk:** <https://www.f6publishing.com/helpdesk>  
<https://www.wjgnet.com>

