Case Report

Robotic hysterectomy in Trendelenburg position in a severely anaemic JKa alloimmunised patient with impending high-output cardiac failure: An anaesthetic challenge

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ABSTRACT

Kidd blood group alloimmunisation, though extremely rare, may produce considerable morbidity, and even mortality. Severe anaemia and impending high-output cardiac failure requiring blood transfusion should be weighed against the risk of severe transfusion reactions even with fully cross-matched blood. Kidd antibodies are a common cause of delayed haemolytic transfusion reaction (DHTR) since they have a tendency remain undetectable in plasma. A low -grade DHTR (second hit) was grossly amplified by a second DHTR (third hit) superimposed on it in our patient leading to severe haemolysis with serum bilirubin reaching 68 mg%. Indirect antiglobulin test (indirect Coombs reaction) should ideally be performed in all patients (scheduled for major surgery requiring blood transfusion) who have experienced a previous pregnancy or blood transfusion. Non-invasive continuous haemoglobin monitoring and non-invasive cardiac output monitoring can prove invaluable tools in management.

Key words: Anaemia, autoimmune, haemolytic, hyperbilirubinemia, Kidd blood group system, robotic surgical procedures

INTRODUCTION

Kidd antigens (JKa; JKb andJK3) are expressed exclusively on the red blood cell (RBC) membranes and vasa recta of the kidneys. They serve as urea transporters to maintain osmotic stability of RBCs. Medullary urea plays a major role in concentration of urine.[1] Kidd blood group alloimmunisation is extremely rare. Produced in response to blood transfusion or pregnancy, these antibodies may precipitate often mild but sometimes fatal haemolytic transfusion reactions.[2] We describe the perioperative management of one such rare case who underwent robotic hysterectomy.

CASE REPORT

Our patient was a 56-year-old female, weighing 45 kg suffering from haemolytic anaemia, paroxysmal nocturnal haemoglobinuria (PNH) and jaundice for the past 30 years. She was admitted with a diagnosis of carcinoma endometrium with profuse bleeding per vaginum. She had hepatosplenomegaly (16 cm × 18 cm). Her transaminase levels were normal while serum lactate dehydrogenase was elevated (247 IU/L). Her viral markers were negative. She tested positive for indirect anti human globulin test. Haematological workup revealed anti-JKa (Kiddgroup) antibodies in her blood. Investigations for beta thalassaemia, other haemoglobinopathies and G6PD deficiency were negative. Pre-operative echocardiography revealed left ventricular (LV)

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ejection fraction 51% with mild-LV dilatation and mild-LV hypertrophy).

She was scheduled for urgent robot-assisted radical hysterectomy. Blood haemoglobin was 6.2 g% despite one unit blood transfusion a week back, and total serum bilirubin was 3.7 mg%, Pre-operative packed red blood cell (PRBC) transfusion attempted in the ward the night before surgery was abandoned following the development of hyperpyrexia, severe chills and rigors. The PRBCs given were best-matched. PRBC transfusion was immediately stopped. Intravenous (IV) pheniraminemaleate 23 mg, hydrocortisone 100 mg, dexamethasone 8 mg and paracetamol 1g, respectively, were administered. Transfusion reaction workup was done in the blood bank and included clerical check, blood group, cross-match, direct Coombs test and indirect Coombs test (ICT) on patient's pre and post-reaction blood samples. Blood for culture was also sent from patient's blood sample and blood from the bag. After screening 28 units of ABO-Rh compatible blood, the blood bank could provide four units of fully cross-matched JKa-negative PRBCs. All 28 units were tested against anti-Jka anti sera before cross-match. Column agglutination technique with polyspecific (IgG and anti-C3d) anti-human globulin cards were used for cross-matching. The blood group of the patient was B Rh Positive. Patient's Rh and Kell antigen phenotype was DCce. All the PRBC units were extended phenotype for Rh and Kell antigens and unit's phenotype issue for transfusion were DCe.

Preoperatively, she had tachycardia (157 beats/min), blood pressure 123/58 mmHg and LV dilatation on echocardiography, suggestive of impending high-output cardiac failure (HOCF). Total leucocyte count was not raised. There was no evidence of pontine haemorrhage, neuroleptic malignant syndrome or heat stroke.

The patient was euthyroid, and pheochromocytoma was ruled out by the normal preoperative plasma metanephrines; urinary vanillylmandellic acid and by abdominal ultrasound. ECG, non-invasive blood pressure, end-tidal carbon dioxide and non-invasive continuous haemoglobin (SpHb) pulse co-oximeter (Masimo®, Irvine, CA).[3] were applied. A peripherally inserted central venous catheter was placed in the right basilic vein. Invasive blood pressure could not be measured due to difficulty in arterial cannulation. However, a non-invasive cardiac output (CO) monitor (ICON™; Osypka Medical GmbH, Berlin, Germany)[4] was applied.

Anaesthesia was induced with IV fentanyl 100 μg, propofol 50 mg, esmolol 30 mg and atracurium 50 mg. Her direct laryngoscopic view was Cormack-Lehane Grade-III. The heart rate peaked to 177 beats/min during intubation and was 160–165 beats/min 10 min after intubation despite giving 100 mg esmolol, 4 mg metoprolol and 400 ml Plasmalyte™ (Baxter Healthcare, Deerfield, IL, USA). One unit of JKa-negative blood was already on flow when the patient arrived, and two more units were transfused intraoperatively. The SpHb values were 6.9, 7.4 and 8.6 g% and the heart rates were 156, 142 and 111 beats per min after completion of the first, second and third units of PRBCs, respectively.

After induction of anaesthesia, on urinary bladder catheterisation the urine was very dark coloured. The nasopharyngeal temperature probe showed an initial reading of 40.9°C. Active cooling measures were undertaken with cold IV fluids including three units of cold PRBCs, ice-cold saline through nasogastric tube and; exposure to cold ambient temperature (23°C). IV paracetamol 1000 mg was administered. The ICON™ non-invasive cardiac output monitor provided cardiac parameters by electrical cardiometry and velocimetry: (CO: 4.41–7.78 l/min), systemic vascular resistance (784–1033 dynes/cm^5; Normal range: 1000–1500 dynes/cm^5), (stroke volume variation: 5%–20%; Normal range: 4%–14%), index of contractility (ICON: 22.5–74.9;Normalrange: 40–60), (systolic time ratio: 0.25–0.83; Normal range: 0.3–0.5) and (thoracic fluid content: 23–33 l/kOhms; Normalrange: 25–35l/kOhms).

Anaesthesia was maintained with bispectral index-guided propofol infusion, peripheral nerve stimulator-guided atracurium infusion, sevoflurane in medical air and metoprolol infusion titrated to heart rate. IV 20% mannitol infusion (200 ml) and IV furosemide 20mg were administered for renal protection. Urine output was normal, but urine remained dark throughout surgery (80 min). On neuromuscular blockade reversal with neostigmine 2.5 mg and glycopyrrolate 0.4 mg, the core body temperature was 37.8°C. She was conscious, oriented and pain-free at extubation.

Postoperative liver function tests revealed elevated serum bilirubin levels of total/indirect: 44.9/24.9 mg% an hour after surgery, 68/35 mg%18 h post-surgery,

Table 1: Post-operative trends in blood investigations

Blood investigations	1 h	18 h	24 h	36 h
Serum bilirubin (total/indirect) (mg%)	44.9/24.9	68/35	24.7/13	11.8/7.4
Serum haemoglobin (g%)	8.6	7.8	6.9	6.9
PCV	27.7	ND	ND	ND
DLC (P/L/M/E/B) (%)	ND	97.4/1.2/1.3/0.3/0.1	ND	91.9/5.8/2.2/0.1/0
PT/INR	19.8/1.55	18/1.38	17.1/1.28	16.8/1.26
Blood urea/serum creatinine (mg%)	ND	ND	90/0.1	43/0.8
SGOT/SGPT (units/litre)	152/20	135/24	60/20	36/17
Serum alkaline phosphatase (units/litre)	72	ND	66	59
Serum sodium/potassium (meq/l)	ND	146/3.7	ND	140/4.2
Serum protein (total/albumin) (g%)	5.6/3.1	ND	5.7/3.2	5.6/3.0

PCV – Packed cell volume; PT – Prothrombin time; INR – International normalised ratio; SGOT – Serum glutamic oxaloacetic transaminase; SGPT – Serum glutamic pyruvic transaminase; DLC – Differential leucocyte count; P/L/M/C/B – Polymorphonuclear leukocyte/lymphocyte/monocyte/eosinophil/basophil); ND – Not done

24.7/13 mg% 24 h post-operatively and 11.8/7.4 mg% 36 h post-surgery [Table 1]. Patient's post-transfusion serum and plasma samples were inspected for evidence of haemolysis on obtaining a bilirubin value of 68 mg%, and no on-going haemolysis was detected. Thereafter, the urine had begun to clear and the bilirubin levels began reducing. Haemoglobin/packed cell volume levels were 8.6 g%/27.7, 7.8 g%/25.1 and 6.9 g%/22.5% immediately post-operative and on the 1st and 2nd post-operative days, respectively. Postoperatively, she was administered mannitol 50 ml intravenously 6 hourly, IV furosemide 10 mg every 8 h, ursodeoxycholic acid 300 mg through nasogastric tube 8 hourly. She was discharged on the 6th post-operative day and was recalled 10 days later for follow-up and radiotherapy.

The transfusions given preoperatively were best-matched units and were selected based just on cross-match compatibility. The transfusions given 1 week before surgery were JKa negative. The intra- and post-operative transfusions were also JKa negative.

DISCUSSION

Robotic surgery had both pros (reduced blood loss) and cons (cardiorespiratory changes due to steep Trendelenburg position) in our case. Her urine was mildly dark coloured pre operatively and for the past 25–30 years. She had severe tachycardia and impending HOCF. For every 1°C rise in body temperature, there is an increment in heart rate by10 beats/min. Hence, the extreme tachycardia could not be explained by fever alone. In a severely anaemic patient, fluid overload can result in HOCF and transfusion of PRBCs is recommended intraoperatively instead of IV crystalloids. In JKa-positive patients, only JKa-negative blood is safe for transfusion. Therefore, we transfused three units of cold JKa-negative packed red cells intraoperatively. This reduced the tachycardia, improved the haemodynamics and reduced the body temperature as well. ICON™ CO monitor gave us real-time values of force of contraction, stroke volume and thoracic water content so that HOCF could be averted.

The prevalence of JKb antigen in the Indian, Caucasian, Black and Chinese populations is 68%, 74%, 48%and 76%, respectively.[5] It follows that 32% of Indians may develop anti-JKa antibodies (IgG1 and IgG3) if exposed to blood with JKa antigen (JKpositive). Antibodies may produce both extravascular and intravascular haemolysis. However, usually, these antigen-antibody reactions are not severe enough to cause anything beyond mild febrile reactions. However, in rare cases like in our patient, JKa alloimmunisation may occur and lead to severe haemolysis, hyperbilirubinemia and hyperpyrexia. Anti-JKa antibodies are a frequent cause of delayed haemolytic transfusion reaction (DHTR)[6-8]and acute haemolytic transfusion reaction (AHTR) is rare.[6] ICT may, therefore, be performed in all patients (scheduled for major surgery requiring blood transfusion), who have experienced a previous pregnancy or blood transfusion. In fact, indirect antiglobulin/Coombs test is being routinely performed in blood banks of all reputed hospitals to check for minor irregular antibodies and is referred to as patient's 'antibody screening'.

Post-operative elevated bilirubin levels can partly be explained as a DHTR to JKa-positive blood transfused 1 week earlier (second hit) and accelerated by a second PRBC transfusion night before surgery (third hit). Bilirubin levels of 68 mg% are extremely rare in DHTR but a possibility all the same. By 'second hit and third hit', we mean the 'secondary and tertiary immune response' in case of DHTR. Because the primary immune response could have already occurred with a previous pregnancy, the first transfusion of random

JK (a + b+) could have caused a secondary immune response, that resulted in the haemolysis of the second JK(a+b−) transfused unit.

A recent large retrospective multi-centric study[9] showed that anti-JKa was the cause of a secondary response in a short interval of time after transfusion (14 days after the first transfusion). The level of antibody was such that serological detection was only possible using the most sensitive techniques.

Anti-JKa antibodies are hard to detect in titres below 1:16 and the cross-matched sample can appear to be normal. In one case, significant haemolysis caused by anti-JKa was detected only in solid-phase and by Erythrocytes Magnetized® technology and not by column or liquid-tube technologies.[10] This is clinically significant because severe haemolytic reactions may follow transfusions with apparently compatible, fully cross-matched blood.[11] The three, so-called, fully cross-matched JKa-negative blood samples might have got JKa antigens which were not agglutinated by the JKa antibodies due to a low titre of antibodies. However, again it is rare for antibodies in such low titres to cause such severe AHTR.

Another unanswered query was that, if the rise in bilirubin was purely due to haemolysis, then why did the direct bilirubin too, rise along with the indirect bilirubin. Volatile anaesthetics cannot be incriminated as no such agent (halothane) was used in the anaesthetic technique. Post-operative sonography excluded common bile duct obstruction or acute hepatitis and the hepatic haemangioma, gallstones and splenomegaly were the same as noted preoperatively. Clerical error was excluded as a cause of mismatch. Mechanical haemolysis due to an enlarged spleen and surgical stress could have contributed. PNH could also have played a role in the severe haemolysis.

Pharmacological agents such as erythropoietin (150 IU/Kg/thrice a week for 2–6 weeks raises Hb by 1g%) may be administered to build up haemoglobin if the surgery is not an emergency surgery.

Intraoperative IV tranexamic acid maybe administered to minimise intraoperative blood loss.

Blood transfusions in such patients should have a very low transfusion-trigger (maybe even 5g%). Despite knowing this, we may still have to transfuse blood to avert impending HOCF. Despite taking all precautions such as transfusing JKa-negative blood, haemolysis may still occur. SpHb and non-invasive cardiac output monitoring can prove invaluable tools in management.

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Conflicts of interest

There are no conflicts of interest.

REFERENCES

1. Lucien N, Sidoux-Walter F, Roudier N, Ripoche P, Huet M, Trinh-Trang-Tan MM, *et al.* Antigenic and functional properties of the human red blood cell urea transporter hUT-B1. J BiolChem 2002;277:34101-8.
2. Lawicki S, Covin RB, Powers AA. The Kidd (JK) blood group system. Transfus Med Rev 2017;31:165-72.
3. Ehrenfeld JM, Henneman JP, Bulka CM, Sandberg WS. Continuous non-invasive hemoglobin monitoring during orthopedic surgery: A randomized trial. J Blood Disord Transf 2014;5:9-12.
4. Zoremba N, Bickenbach J, Krauss B, Rossaint R, Kuhlen R, Schälte G, *et al.* Comparison of electrical velocimetry and thermodilution techniques for the measurement of cardiac output. Acta Anaesthesiol Scand 2007;51:1314-9.
5. Makroo RN, Bhatia A, Gupta R, Phillip J. Prevalence of Rh, Duffy, Kell, Kidd and MNSs blood group antigens in the Indian blood donor population. Indian J Med Res 2013;137:521-6.
6. Storry JR. Other blood group systems and antigens. In: Roback JD, Combs MR, Grossman BJ, editors. Technical Manual. 16th ed. Bethesda, MD: American Association of Blood Banks; 2008. p. 423-5.
7. Malhotra S, Kaur G, Singh L, Basu S, Lehl SS. Delayed haemolytic reaction due to anti Jkaalloimmunisation. Int J Blood Transfus Immunohematol 2011;1:16-9.
8. Sahu S, Hemlata, Verma A. Adverse events related to blood transfusion. Indian J Anaesth 2014;58:543-51.
9. Schonewille H, van de Watering LM, Loomans DS, Brand A. Red blood cell alloantibodies after transfusion: Factors influencing incidence and specificity. Transfusion 2006;46:250-6.
10. Villa MA, Moulds M, Coluccio EB, Pizzi MN, Paccapelo C, Revelli N *et al.* An acute haemolytic transfusion reaction due to anti-jk. Blood Transfus 2007;5:102-6.
11. Oberman HA, Barnes BA, Steiner EA. Role of the crossmatch in testing for serologic incompatibility. Transfusion 1982;22:12-6.