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## **Emergency surgery for a ruptured ovarian cyst in an anticoagulated patient with artificial mitral valve and massive haemorrhage: Maintaining a delicate balance**

Sir,

Long-term anticoagulation is required in patients with artificial heart valves to avoid thromboembolic complications. In such cases, a target international normalised ratio (INR) has to be maintained for anticoagulation to prevent thromboembolism which needs to be balanced carefully to avoid haemorrhagic complications, owing to narrow therapeutic index of vitamin K antagonists.<sup>[1,2]</sup> There is a lot of controversy and ambiguity regarding the type of treatment required

to reverse anticoagulation for emergency surgery and the ideal time to restart anticoagulation therapy safely.<sup>[1-3]</sup>

A 22-year-old female presented with abdominal pain since one day with a history of open heart surgery seven months back (mitral valve replacement: TTK<sup>®</sup> 25mm Chitra heart valve prosthesis). She was taking oral warfarin 5 mg once daily with an INR of 2.7 which was done 2 months back. On examination, there was low volume pulse rate of 116/min, noninvasive blood pressure of 96/50 mmHg and respiratory rate of 22/min with a SpO<sub>2</sub> of 96% on room air. She was anxious but alert and oriented. She was resuscitated with 1 L of crystalloids till her vitals were relatively stable. Bedside ultrasonography was suggestive of gross ascites and free floating shadows suspected due to a haemorrhagic right ovarian cyst and she was planned for an emergency laparotomy.

Bedside transthoracic echocardiography (TTE) was done to screen functionality of the valve and left

ventricular functional status which was normal. Blood reports revealed haemoglobin (Hb) of 6.8 g%, serum creatinine of 1.32 mg/dL and INR of 3.4. Use of inj. vitamin K was withheld considering the patient was at a high risk of valve thrombosis, and because the goal was to shift the patient back on anticoagulation postoperatively.

General anaesthesia was induced with fentanyl, etomidate and atracurium, and anaesthesia was maintained with oxygen, sevoflurane and air. Fresh frozen plasma (FFP) infusion was started, and after infusion of two units, simultaneous insertion of invasive arterial line was done. In addition to two broad gauge peripheral intravenous catheters, right external jugular vein was cannulated with a 5F double-lumen central venous catheter through Seldinger over the wire technique through an intravenous cannula, with the aim to postpone puncturing a deeper central vein till coagulation profile was stable. Around 2 L of blood was suctioned from the peritoneal cavity, and salpingectomy and ovariectomy were completed. Intraoperatively, two units of packed red blood cells (PRBCs) and four units of FFP (800 mL) were given along with crystalloids. Her vitals remained stable and urine output was 80 mL in the 2-h procedure.

The patient received ventilatory support in the intensive care unit to ensure complete neuromuscular recovery and to support work of breathing. Postoperative TTE revealed no significant changes compared with preoperative status. Immediate postoperative Hb was 5.7 g% and INR 1.6. PRBC three units and one unit of FFP were transfused slowly, and after 4 h INR was 1.42. Unfractionated heparin infusion was started 6 h postoperatively. She was extubated 12 h postoperatively. Warfarin was started 3 days after surgery. Rest of the hospital stay till discharge was uneventful.

Spontaneous bleeding is one of the most common adverse effects of warfarin, and factors such as old age, dose, duration of therapy, drug interaction and occult diseases further determine the risk of bleeding.<sup>[4]</sup> Strict monitoring of the coagulation profile in patients taking long-term warfarin is essential. Women in the reproductive age group can present with bleeding and haemorrhage often related to a ruptured corpus luteum cyst. Haemoperitoneum in such patients on anticoagulants is a rare and sometimes scary scenario to encounter.<sup>[2]</sup> Such patients present a challenge as abrupt reversal of anticoagulation is required to

control any ongoing haemorrhage and further surgical blood loss.<sup>[3]</sup>

In patients receiving vitamin K antagonist, there are generally three options for urgent reversal of anticoagulant effect: vitamin K, prothrombinase complex concentrate (PCC) and FFP. PCC is pooled from donor plasma, reconstituted for clotting factor replacement and is available in powder form. It contains coagulation factors II, VII, IX and X and anticoagulant proteins C and S with concentration of clotting factors in PCC approximately 25 times higher than in FFP. The typical recommended dose is 25–50 IU/kg, after initial infusion of 500–1000 IU at a rate of 100 IU/min, and subsequent infusion should be at 25 IU/min or less. Four-factor PCCs provide more rapid and complete reversal than FFP, and without the possible side effects of transfusing large volumes of plasma.<sup>[1,4]</sup>

FFP if immediately available and prethawed can be used in a patient requiring volume restoration and warfarin reversal.<sup>[4]</sup> However, there is higher PCC-associated thrombotic risk because of high level of factor II in the PCC (relative to the other factors), which is known to increase thrombin generation. The half-life of administered factor VII is only 6 h, and therefore vitamin K should be given simultaneously to cover the period after the effects of PCC/FFP have worn off by allowing an endogenous regeneration of the missing factors.

It is recommended that high-dose (10 mg) vitamin K must not be used routinely in patients with high risk of mechanical valve thrombosis as this may create a hypercoagulable state with further risk. In addition, high-dose vitamin K may lead to warfarin resistance due to accumulation of vitamin K in the liver, necessitating use of higher doses of warfarin later to achieve therapeutic INR levels and increasing the risk of thromboembolism during this period.<sup>[1]</sup> Hence, FFP alone or in combination with low-dose vitamin K (1–2 mg intravenous) is preferable in patients with mechanical mitral valves.<sup>[1,5]</sup>

To conclude, in patients with high risk of valve thrombosis for emergency reversal of anticoagulation, use of vitamin K should either be avoided or used in a low dose. FFP should be preferred over PCC to avoid higher thrombotic risk related to use of the latter.

#### Declaration of patient consent

The authors certify that they have obtained all

appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

#### Financial support and sponsorship

Nil.

#### Conflicts of interest

There are no conflicts of interest.

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Access this article online	
Quick response code	Website: www.ijaweb.org
	DOI: 10.4103/ija.IJA_18_19

**How to cite this article:** Singh U, Agarwal R, Dhar M, Biswas S. Emergency surgery for a ruptured ovarian cyst in an anticoagulated patient with artificial mitral valve and massive haemorrhage: Maintaining a delicate balance. Indian J Anaesth 2019;63:499-501.

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