I-gel™ May be the Device of Choice for Controlled Ventilation in Patients with Hemophilia Undergoing Abdominal Laparoscopic Surgery

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Abstract

Haemophilia is an inherited bleeding disorder with variable deficiency of Factor VIII in the plasma and is characterised by bleeding into joints, muscles and tissues either spontaneously or in response to trivial trauma. Perioperative care requires multidisciplinary involvement. Perioperative management involves the risk of excessive bleeding from surgical site as well as spontaneous bleeding into the brain in response to surgical stress in patients with previous history of intracerebral haemorrhage. Airway management of such patients during anaesthetic intervention is a challenge and entails the risk of life threatening haemorrhage into the airway. The I gel Supraglottic airway device may be best suited for the purpose considering its soft elastomeric non-inflatable cuff, ease of insertion, availability of gastric suction port and minimal leak fraction on controlled ventilation. The I Gel may be solution to avoiding airway instrumentation in patients with bleeding disorders. It may be an alternative to endotracheal intubation in patients with Haemophilia undergoing surgery.

Keywords: Hemophilia A, I-gel, intracerebral hemorrhage

INTRODUCTION

The I-gel™ (Intersurgical Limited, Wokingham, UK) is a second generation supraglottic airway device (SAD) made of a thermoplastic elastomer with a noninflatable cuff, which conforms to the perilaryngeal structures allowing both spontaneous and controlled ventilation. It is easier to insert than other SAD and can be used as a conduit for fiberoptic intubation in patients with difficult airway. It has been successfully used for controlled ventilation in laparoscopic surgeries and has been found to have an oropharyngeal seal pressure of 28 cm H$_2$O.\textsuperscript{[1]} However, until date, there are no clinical studies stating the use of I-gel in patients with severe bleeding disorders. We report the successful use of I-gel for anesthetic management in a patient with severe Hemophilia A posted for laparoscopic cholecystectomy with multiple episodes of intracerebral hemorrhage (ICH) in the past.

CASE REPORT

A 28-year-old male diagnosed with severe Hemophilia A was posted for laparoscopic cholecystectomy. Medical history included four episodes of ICH through age 2–8 years with spontaneous hemarthrosis leading to deformity of both the ankles, elbows, and left shoulder joint. He was treated with fresh frozen plasma and Factor VIII cryoprecipitate since diagnosis and received Factor VIII concentrate 2000 IU intravenous thrice weekly since last 2 years. He received levotiracetam tablets 250 mg and levothyroxine tablets 125 μg once daily as anticonvulsant prophylaxis and hypothyroidism, respectively. Clinical examination revealed a 70 kg male without systemic co-morbidities. Airway assessment, hematological, biochemical parameters, 12 lead electrocardiography, chest radiograph, and computed tomography scan brain were normal. Coagulation study revealed a prolonged activated partial thromboplastin time (APTT) of 84 s and an international normalized ratio 0.98.

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Optimal patient care required a multidisciplinary approach. General anesthesia with I-gel™ supraglottic device was planned. Factor VIII replacement regimen during perioperative period was prescribed by hematologist. An 18 gauze intravenous cannula was inserted into the left radial vein in the preoperative preparation area. 4000 Unit of recombinant Factor VIII (RECOMBINE, Baxter 1000 IU/ml) was administered intravenously 30 min before anesthetic intervention. Standard American Society of Anesthesiologists monitoring techniques were used. Adequate padding was applied to protect deformed and fixed joints. One gram tranexamic acid was administered intravenously before induction of anesthesia. Premedication with intravenous glycopyrrolate 0.2 mg, midazolam 2 mg, and fentanyl 150 μg was followed by induction of anesthesia with 150 mg propofol. Neuromuscular blockade was achieved with 70 mg rocuronium after assessing the adequacy of positive pressure ventilation with bag and mask. No. 4 I-gel™ was then introduced gently in a single attempt and secured in position after assessing the adequacy of ventilation. A 12 FR nasogastric tube was introduced through the gastric suction port. Volume controlled ventilation was set at tidal volume 8 ml/kg and respiratory rate 14 min⁻¹. Anesthesia was maintained with 33% oxygen 66% nitrous oxide with 0.5–1 MAC sevoflurane with intermittent doses of rocuronium. Analgesia was supplemented with 1 g paracetamol infusion and 100 mg tramadol injection. Inje     
ction ondansetron 8 mg was administered to prevent postoperative nausea and vomiting. Hemodynamic stability was maintained throughout surgery and peak air pressure ranged from 20 to 22 cm H₂O. Arterial oxygen saturation of 98–100% and ETCO₂ of 30–40 mmHg was maintained throughout the intraoperative period. Duration of surgery was 90 min. Neuromuscular blockade was reversed with 3.5 mg neostigmine and 0.4 mg glycopyrrolate. I-gel™ was removed gently after suction of nasogastric tube. Postoperative analgesia was maintained with the intravenous patient-controlled analgesia (PCA) for 24 h using Fentanyl with background infusion rate of 0.5 μg/kg/h and a bolus dose of 0.5 μg/kg with a lockout period of 15 min along with intravenous injection paracetamol 1 g administered thrice daily. 4000 IU of recombinant Factor VIII was administered intravenously 6 h after the first dose followed by 12 hourly dosing over the first 3 postoperative days. 2000 IU were administered 12 hourly over next 3 postoperative days. The patient was discharged on the 2nd postoperative day. Postoperative course was uneventful with no history of bleeding from the surgical site or into any joints on follow-up.

**DISCUSSION**

Hemophilia A is a congenital bleeding disorder transmitted as an X-linked recessive trait characterized by deficiency of Factor VIII in the plasma causing prolonged aPTT. Severe disease (Factor VIII activity <1%) is characterized by spontaneous bleeding into joints, muscles, and soft tissues or in response to trivial trauma. Replacement therapy with recombinant Factor VIII concentrate is done as prophylaxis or in response to the bleeding episode. 1 IU/kg body weight Factor VIII raises activity by 2%.[2] Our patient was diagnosed as severe and inescapable hemophilia A with baseline Factor VIII activity <1% with four episodes of ICH and hemarthrosis. Anesthetic management for laparoscopic cholecystectomy was directed toward perioperative replacement of Factor VIII and avoidance of factors which could precipitate ICH. Factor VIII activity was raised to and maintained at 100% during first 3 postoperative days followed by 50% activity from day 4 to 7.[1] We administered 1 gm tranexamic acid prior to induction of anesthesia to enhance clot stability and improve hemostasis.[4] Positioning the patient was difficult due to the presence of multiple fixed joint deformities. Hand- rests were adjusted and optimum padding provided to maintain limbs in a neutral position and prevent trauma. General anesthesia with volume controlled ventilation was planned. Airway management in our patient was a challenge due to underlying bleeding disorder and history of ICH which increases the risk of recurrence.[5] Laryngoscopy and intubation are associated with greater incidence of hemodynamic perturbations when compared to insertion of SAD.[6] Airway manipulation during direct laryngoscopy may lead to life-threatening submucosal hemorrhage in Hemophilia. I-gel™ is a unique supraglottic device with a noninflatable cuff made of a thermoplastic elastomer with a soft gel like feel designed anatomically to fit the perilyngeal and hypopharyngeal structures.[7] It allows easier insertion, a lesser degree of sympathetic response and adequate ventilation when compared to endotracheal intubation and other SADs like LMA Proseal.[9,10] I-gel™ has been used successfully in the past for various surgeries without the risk of regurgitation and aspiration of gastric contents.[11] Hence, we chose to secure the airway with a no. 4 I-gel following induction of anesthesia. Insertion of the device was smooth. The presence of a gastric port allowed continuous gastric drainage without the requirement of a nasogastric tube and subsequent possibility of trauma to the nasal mucosa.[12] Intra-abdominal pressure was maintained at 12–14 mmHg. Ventilation and oxygenation were adequate throughout the intraoperative period with minimum leak fraction.[13-15] Removal of I-gel was done gently with ease and there was no evidence of blood stain on the device.

Maintenance of perioperative analgesia was crucial in our patient. Provision of multimodal analgesia was limited due to contraindication of nonsteroidal anti-inflammatory drugs and intramuscular injections. Numerical rating scale 2/10 was achieved with Fentanyl in intravenous PCA and paracetamol infusion as an adjunct.[6,12] Surgery in patients with bleeding disorders entails a high risk. Anesthetic management of patients with severe bleeding disorders remains a challenge. The advent of novel airway devices and hemostatic agents has made the process safer. The successful management of this case shows that the I-gel can be used as a safer and effective alternative to
endotracheal intubation and LMA Proseal in patients with bleeding disorders.

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**Conflicts of interest**
There are no conflicts of interest.

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