CASE REPORT

Use of i-gel for caesarean section with kyphoscoliosis

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SUMMARY

We describe the anaesthetic management using i-gel for airway maintenance in a patient with kyphoscoliosis presenting for emergency caesarean section due to fetal distress and scar tenderness. The patient had a history of previous caesarean section under general anaesthesia, and presently her cardiorespiratory status is stable. We used i-gel, the new supraglottic airway device, for maintaining the airway under intravenous anaesthesia using propofol.

BACKGROUND

I-gel is a novel, single use and latex-free supraglottic airway device. It is made of medical grade thermoplastic elastomer, anatomically preformed to mirror the peri-laryngeal structures.¹ It consists of a soft non-inflatable cuff and two channels, that is, gastric and airway. It is easy to use and stability after insertion is good. It is used for spontaneous and controlled ventilation with an adequate seal pressure of 24 cm H₂O.^{2–3} It is used as a rescue device in case of an unexpectedly difficult intubation scenario for maintaining a clear airway as well as for intubation through the device.^{4–5} In this case report, we describe the use of i-gel in a patient with kyphoscoliosis posted for emergency caesarean section.

Kyphoscoliosis is a deformity of the spine with a lateral curvature and rotation of the vertebrae, as well as deformity of the rib cage. It can be idiopathic or secondary.^{6–7} The incidence of idiopathic kyphoscoliosis is 75–90% with a female predominance of 4%. Patients associated with neuromuscular disease and congenital abnormalities, including congenital heart disease, trauma and mesenchymal disorders, form the remaining 10–25%. The severity of kyphoscoliosis is defined by the angle of scoliosis or Cobb's angle. Kyphoscoliosis has profound effects on the respiratory and cardiovascular systems. Hence, anaesthetising a patient with kyphoscoliosis for emergency section can be potentially difficult. Central neuraxial block can be technically difficult and the level may be unpredictable. These patients are prone to respiratory failure in the postoperative period due to the residual effect of sedatives and muscle relaxants. A technique using propofol infusion maintaining spontaneous respiration was used.

Severe scoliosis is rare in parturients, varying from 1:1500 to 1:12 000 pregnancies.⁸

We used i-gel in this case, in view of her lung pathology and gross anatomical deformity of the thorax.

CASE PRESENTATION

A 25-year-old second gravida with a history of previous caesarean section and scar tenderness presented for emergency caesarean section. She had developed a severe spinal deformity in her childhood. She did not have any history of trauma or tuberculosis. She was asymptomatic until adulthood, except for mild dyspnoea during pregnancy. She could not give a proper history of her previous caesarean section except that a failed spinal was converted to general anaesthesia. She had taken her last meal 6 h prior to arrival at the theatre. Her symptoms were pain over the site of the previous scar and a drop in fetal movements. She came at full-term pregnancy for emergency caesarean section.

She was short statured (height 130 cm and weight 42 kg) and had severe thoracolumbar kyphoscoliosis with deformity of the thoracic cage and rotation of vertebral bodies. Her respiratory rate was 15 bpm, pulse rate 130 beats with BP-110/60 mm Hg and SPO₂ 98% on room air. On arrival at the operation theatre, monitors were connected and baseline parameters of pulse rate, blood pressure and oxygen saturation noted. The fetal heart rate was also noted. After explaining to the patient, an intravenous line was secured and an infusion of Ringer's lactate started. She was then premedicated with hydrocortisone 100 mg, injection ranitidine 50 mg, injection ondansetron 4 mg and injection glycopyrrolate 0.2 mg for aspiration prophylaxis. Later, after taking aseptic precautions, the scar site was infiltrated with 10 mL of 2% lidocaine. After 5 min of preoxygenation, anaesthesia was induced with propofol 2 mg/kg and fentanyl 1 µg/kg. Next, cricoid pressure was applied and mask ventilation started following which size 4 i-gel was inserted at the first attempt. Positive pressure ventilation with i-gel was effective with no audible leak (peak airway pressure of 18 cm H₂O). Air entry was checked by bilateral chest auscultation and confirmed by capnography. Cricoid pressure was then released and Ryle's tube inserted through the i-gel. During the intraoperative period, anaesthesia was maintained with a propofol infusion maintaining spontaneous ventilation. The duration of the surgery was 45 min and her vitals remained within normal range throughout this period. A male infant weighing 2 kg with an APGAR of 9/9 was delivered with no consequent postpartum bleeding. Intraoperatively, 1 L of ringer lactate was given. Local infiltration of the wound was performed with 0.25% plain bupivacaine along with aqueous diclofenac sodium 75 mg intravenously for postoperative

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analgesia. The i-gel was removed at the end of the surgery once the patient was fully awake after stopping the propofol.

OUTCOME AND FOLLOW-UP

The postoperative period was uneventful. She was discharged on the eighth postoperative day. During this time, we had evaluated her pulmonary functions which showed features of obstructive lung disease. Echocardiography showed normal cardiac function. CT of the spine showed marked kyphotic deformity in the lower dorsal spine (with Cobb's angle of 40°) with the apex of the kyphosis at D₉₋₁₀. There was apposition of the anterior cortices of the D₆ and D₁₂ due to folding over of the vertebral spine.

DISCUSSION

Weinstein and colleague have reported that Cobb's angle could be correlated with pulmonary function test and cardiac failure.⁹⁻¹¹ Surgical correction is performed for Cobb's angles greater than 50°, with the intent of halting progression of respiratory and cardiac dysfunction. Pregnancy may exacerbate the severity of spinal curvature and cardiorespiratory abnormalities in a patient with uncorrected scoliosis curves that have not been stable before pregnancy. This was seen in our patient.^{12 13}

The primary abnormality in gas exchange is ventilation-perfusion maldistribution, which contributes to hypoxaemia. Prolonged hypoxia, hypercapnia and pulmonary vascular constriction may result in irreversible pulmonary vascular changes and pulmonary hypertension. This was not seen in our patient. Diaphragmatic activity gets constrained as the gravid uterus enters the abdominal cavity in the mid-gestation period, thus decreasing the functional residual capacity (FRC) and closing capacity (CC). In kyphoscoliosis, a rise in tidal volume (V_T) is not possible, so minute ventilation can be achieved by increasing the respiratory rate. Oxygen consumption increases above prelabour values by 40% in the first stage and 70% in the second stage.¹³

These patients exhibit right ventricular hypertrophy and hypertensive pulmonary vascular changes. Prolonged alveolar hypoxia due to hypoventilation and ventilation perfusion mismatch eventually causes irreversible vasoconstriction and pulmonary hypertension. These features were not present in our patient. Death at the time of delivery or in the early postpartum period is common in parturients with pulmonary hypertension.¹⁴

Kofoed¹⁵ suggested that complications are more likely to occur in the older patients (>35 years) with severe kyphoscoliosis with an underlying neuromuscular disease. Others at risk are primiparas who develop fatigue during prolonged labour. Premature labour occurs more commonly in scoliotic parturients, independent of the severity of the curve.^{15 16}

In a significant proportion of patients, caesarean section is needed and this relates to the degree of skeletal deformity, resulting in maternal compromise and cephalopelvic disproportion.¹⁷ Caesarean section is difficult with severe curves due to the acute anteflexion of the uterus in the small abdominal cavity resulting from an approximation of the Xiphisternum and the symphysis pubis. The lower uterine segment is inaccessible, as was seen in our case.¹⁸

Antepartum maternal assessment focuses on the cardiorespiratory status of mothers with special attention to the history and current status, and the presence of coexisting disease and associated neuromuscular disorders. Maternal cardiopulmonary compromise and thoracolumbar scoliosis with Cobb's angle greater than 30° require antepartum anaesthetic consultation. A

plan is generated regarding the management of the pregnancy and delivery and it is conveyed to the patient and other team members.¹⁹

The occurrence of a successful spinal block is reduced and complications are more frequent, including unsuccessful insertions of the needle, multiple attempts before successful insertion, false loss of resistance, failed block or inadequate analgesia.²⁰ Problems are more frequent in patients with fusion extending to the lower lumbar and lumbosacral interspaces than in those with fusion ending in the upper lumbar spine. This was seen in our patient. Epidural anaesthesia can be given with a local anaesthetic alone or a local anaesthetic opioid mixture. In parturients with significant cardiovascular compromise, a dilute local anaesthetic opioid mixture (bupivacaine 0.0625–0.125% with 2–4 µg/mL fentanyl at infusion rates of 8–15 mL/h) provides excellent first stage and good second stage analgesia with fewer haemodynamic consequences compared with a more concentrated local anaesthetic solution.²¹

The goals in the anaesthetic management of parturients with pulmonary hypertension include:

1. Avoidance of pain, hypertension, hypoxaemia, hypercarbia and acidosis as these increase PVR;
2. Avoidance of myocardial depression to prevent further reduction in cardiac output;
3. Maintenance of intravascular volume and preload;
4. Maintenance of systemic vascular resistance so as to ensure myocardial perfusion and prevent right to left shunting.²²

Systemic hypotension resulting from a regional block may lead to right ventricular ischaemia and a profound reduction in cardiac output. Owing to the fact that cardiac output is relatively fixed in a patient with pulmonary hypertension, hypotension due to decreased systemic vascular resistance may elicit little physiological compensation and be difficult to treat pharmacologically. Invasive cardiac monitoring for continuous assessment of maternal blood pressure and central venous pressure is recommended for patients with cardiorespiratory dysfunction.

Some argue that general anaesthesia is preferable because it provides airway and ventilator control. Alternatively, regional anaesthesia can be given unless technical difficulties preclude performance of a regional block or maternal decompensation is imminent. A slow incremental extension of an epidural or a subarachnoid block provides ideal conditions for operative delivery and postoperative analgesia. Particular attention should be paid to the dose of the local anaesthetic because the patient's small size renders usual volumes toxic. In patients with severe curves, a subarachnoid hyperbaric local anaesthetic solution may pool in the dependent portion of the spine, resulting in an inadequate block.^{23 24} General anaesthesia may be indicated because of the maternal preference or maternal cardiopulmonary disease or because of technical difficulties related to the regional block. A thorough evaluation of the maternal airway is necessary because a number of conditions may be associated with scoliosis (difficult laryngoscopy and intubation). Patients may be at particular risk for airway complications perioperatively as general anaesthesia causes relaxation of the pharyngolaryngeal elements. This was not seen in our patient.

The potential hazards of general anaesthesia in parturients with pulmonary hypertension include the increase in pulmonary artery pressure during laryngoscopy and intubation. We avoided this by inserting an i-gel. The adverse effects of positive pressure ventilation on venous return and negative inotropic effects of anaesthetic agents were avoided as we kept our patient on spontaneous respiration. These adverse effects can be largely

attenuated by an opioid supplement during induction and maintenance as we did in our patient. We avoided nitrous oxide because it increases PVR.²⁴ The patient should be in an intensive care setting for up to a week following delivery as major cardiopulmonary complications are common during this period.

General anaesthesia, tracheal intubation and surgery result in mucociliary dysfunction and abnormal or retrograde mucous flow. Reduced competence of the larynx increases the potential for postextubation aspiration. Bucking at the end of the surgery may transiently and significantly reduce FRC, resulting in a further ventilation/perfusion mismatch and hypoxaemia.²⁵ We avoided all this by using i-gel and keeping the patient on spontaneous ventilation.

Other factors contributing to postoperative hypoxaemia in scoliotic parturients are increased ventilation/perfusion mismatch, increased alveolar to arterial oxygen gradient, inhibition of hypoxic pulmonary vasoconstriction, decreased cardiac output, underlying pre-existent pulmonary disease and restriction of chest wall movement. We avoided all the above complications as our patient was on spontaneous ventilation.

Even though the patient had no cardiorespiratory symptoms except fetal distress and scar tenderness and her pulmonary function was not compromised, considering the history of a failed spinal block in the previous caesarean section, we preferred general anaesthesia as the technique of choice. The patient was kept on spontaneous ventilation using a supraglottic device size 4 i-gel as high seal pressure is required in pregnant patients. Even though there is sufficient evidence for use of a proceal laryngeal mask airway in pregnant patients, as it was not available at that particular moment, we used i-gel in the patient.

A supraglottic device may not be a choice for managing the airway for caesarean section, but it is an alternative where intubation may cause haemodynamic changes that will affect the cardiopulmonary outcome in a patient with the pathology involving the cardiac and respiratory systems together. However, this has to be substantiated by randomised clinical trials.

Learning points

- ▶ As the sealing pressure of i-gel is 24 cm H₂O, we can consider using it for maintaining the airway in an emergent situation or exceptional circumstances like our case scenario.
- ▶ However, i-gel cannot be recommended for routine use in pregnant patients.
- ▶ Further randomised controlled studies are needed to guide us regarding the routine use and as a rescue device of i-gel in a pregnant patient. Until we have more insight, we should be cautious in using the devices in pregnant patients for caesarean section.

Contributors SLG had designed the plan for anaesthesia and MSP had executed the plan. MSP and SL jointly prepared the script. GP helped in the execution of the treatment and review of the script.

Competing interests None.

Patient consent Obtained.

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REFERENCES

- 1 Levitan RM, Kinkle WC. Initial anatomic investigation of the i-gel airway: a novel supraglottic airway without inflatable cuff. *Anaesthesia* 2005;60:1022–6.
- 2 Gabbott DA, Beringer R. The I-GEL supraglottic airway: a potential role for resuscitation? *Resuscitation* 2007;73:161–4.
- 3 Richez B, Saltel L, Banchereau F, et al. A new single use supraglottic airway device with a noninflatable cuff and an esophageal vent: an observational study of the I-gel. *Anesth Analg* 2008;106:1137–9.
- 4 Michalek P, Hodgkinson P, Donaldson W. Fiberoptic intubation through an I-gel supraglottic airway in two patients with predicted difficult airway and intellectual disability. *Anesth Analg* 2008;106:1501–4.
- 5 Sharma S, Scott S, Rogers R, et al. The I-gel airway for ventilation and rescue intubation. *Anaesthesia* 2007;62:419–20.
- 6 Hang SY, Byung Te S. Laryngeal mask airway for cesarean section. *World Congress of Anaesthesiology*; 1996;D 770.
- 7 Dysort R: The LMA in pregnancy and postpartum (Abstract) New Zealand Society of Anaesthesiology & Australia College of Anaesthetists. 1993.
- 8 Bickler Dueck R. Kyphoscoliosis complicating pregnancy international. *J Gynecol Obstet* 1996;55:123–8.
- 9 Colin GC, Arthur BD. Pulmonary function in Kyphoscoliosis. *Thorax* 1961;16:282–90.
- 10 James J. *Scoliosis*. Edinburgh: Ghurhill Livingstone, 1976:182–7.
- 11 Bergofsky EH. Respiratory failure in disorders of the thoracic cage. *Am Rev Dis* 1979;119:643–5.
- 12 Hung LT, Pelosi M, Langer A, et al. Blood gas measurements in the kyphoscoliotic gravida and her foetus: report of a case. *Am J Obstet Gynecol* 1975;121:287–9.
- 13 Cobb JR. Outline for the study of scoliosis. Instructional course lecture. *Am Acad Orthop Surg* 1948;5:261.
- 14 Weinstein SL, Zavala DC, Ponseti IV. Idiopathic scoliosis long term follow-up and prognosis in untreated patients. *J Bone Joint Surg Am* 1981;63:702–12.
- 15 Blount WP, Mellencamp DD. The effect of pregnancy on idiopathic scoliosis. *J Bone Joint Surg Am* 1980;62:1083.
- 16 Betz RR, Bunnell WP, Lambrecht Mulier E, et al. Scoliosis and pregnancy. *J Bone Joint Surg Am* 1987;69:90–6.
- 17 Gummerus M, Laasonen H. Eisenmenger complex and pregnancy. *Ann Chir Gynaecol* 1981;70:339.
- 18 Kafer ER. Respiratory and cardiovascular functions in scoliosis and the principles of anesthetic management. *Anesthesiology* 1980;52:339.
- 19 Sawicka EH, Spencer GT, Branthwaite MA. Management of respiratory failure complicating pregnancy in severe kyphoscoliosis: a new use for old technique. *Br J Dis Chest* 1986;80:191.
- 20 Gilbert R, Auchincloss JH Jr. Dyspnea of pregnancy: clinical and physiological observations. *Am J Med Sci* 1966;252:270–6.
- 21 Phelan JP, Dainer MJ, Cowherd DW. Pregnancy complicated by thoracolumbar scoliosis. *South Med J* 1978;71:76.
- 22 Robert NV, Keasti PJ. Pulmonary hypertension and pregnancy a lethal combination. *Anaesth Intensive Care* 1990;18:366.
- 23 Feldstein G, Ramanathan S. Obstetrical lumbar epidural anaesthesia in patients with previous posterior spinal fusion for kyphoscoliosis. *Anesth Analg* 1985;64:83.
- 24 Elliott RD. Continuous infusion epidural analgesia for obstetrics: Bupivacaine versus bupivacaine fentanyl mixture. *Can J Anaesth* 1991;38:303.
- 25 Gamsu G, Singer MM, Vinsent H. Postoperative impairment of mucus transport in the lung. *J Resp Dis* 1976;114:63–9.

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