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SPECIAL ARTICLE

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The value of decision tree analysis in planning anaesthetic care in obstetrics

J.H. Bamber,[a] S.A. Evans[b]
[a]*Department of Anaesthesia, Cambridge University Hospitals NHS Foundation Trust, Cambridge, UK*
[b]*Public Health England, The West Wing, Victoria House, Capital Park, Fulbourn, Cambridge, UK*

ABSTRACT
The use of decision tree analysis is discussed in the context of the anaesthetic and obstetric management of a young pregnant woman with joint hypermobility syndrome with a history of insensitivity to local anaesthesia and a previous difficult intubation due to a tongue tumour. The multidisciplinary clinical decision process resulted in the woman being delivered without complication by elective caesarean section under general anaesthesia after an awake fibreoptic intubation. The decision process used is reviewed and compared retrospectively to a decision tree analytical approach. The benefits and limitations of using decision tree analysis are reviewed and its application in obstetric anaesthesia is discussed.

Keywords: Decision tree analysis; Difficult airway management; Joint hypermobility syndrome; Obstetric anaesthesia; Caesarean section

Introduction

The obstetric anaesthetist often meets clinical situations that involve a choice between alternative management options, balancing the risks and benefits for mother and baby. This paper describes a complex clinical case and the decision making process that was followed and reviews how the clinical decision making could potentially have been improved by the adoption of decision theory methods.

The clinical scenario, decision process and outcome

A 19-year-old woman in her first pregnancy was referred by her obstetricians for an antenatal anaesthetic assessment at 19 weeks of gestation. The obstetricians had also referred her to the regional genetic service who confirmed the diagnosis of joint hypermobility syndrome (JHS) and her history of local anaesthetic insensitivity. Due to a history of easy bruising and a maternal family history of postpartum haemorrhage the woman was referred to the obstetric haematology clinic for investigation. All haematological investigations, including thromboelastography, were normal. She had a history of previous difficult intubations due to a lymphoblastic tumour at the base of her tongue, as well as a possible history of local anaesthetic insensitivity.

The tongue tumour was an indolent T lymphoblastic proliferation which was regarded as benign with no evidence of spread. One biopsy procedure and two surgical debulking procedures had been carried out within the previous 18 months. For the biopsy, the woman had received a general anaesthetic by gas induction, laryngeal mask insertion, and then neuromuscular paralysis with suxamethonium. The intubation was difficult with a grade 4 Cormack-Lehane laryngoscopy view with a standard Macintosh blade and required the assistance of a second senior anaesthetist who had multiple attempts at intubation. The patient did not desaturate during the attempts at intubation. For the first debulking operation, a fibreoptic nasal intubation was undertaken after induction of general anaesthesia by an experienced consultant anaesthetist. This intubation was described as very difficult. The same consultant anaesthetist undertook an awake nasal fibreoptic intubation for the second debulking operation and this time there was some difficulty railroading the tube over the scope.

The history of local anaesthetic insensitivity was related to poor or failed local anaesthesia for a dental extraction and for a bone marrow aspirate.

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Correspondence to: J.H. Bamber, Department of Anaesthesia, Box 93, Cambridge University Hospitals NHS Foundation Trust, Hills Road, Cambridge CB2 0QQ, UK.
E-mail address: james.bamber@addenbrookes.nhs.uk

A decision had to be made on the most appropriate care given the woman's clinical history and the potential risk it posed for a safe delivery. The woman expressed a preference for a normal vaginal delivery with minimal intervention but said that she would accept medical advice as to the recommended safest plan for delivery.

The options for the woman were:

1. To be allowed to labour with the most likely outcome being a normal vaginal delivery but with a 5% risk (based on local data) that a category 1 caesarean section[1] would be required. With labour there would be option to offer early epidural analgesia but with the recognition that there would be at least a 10% failure of adequate pain relief. If an emergency caesarean section under general anaesthesia were required there may be a delay if an awake fibreoptic intubation were selected as the safest option. If instead neuraxial anaesthesia were chosen in preference to general anaesthesia then the risk of failure with the need for conversion to general anaesthesia would be at least 8%[2] with the potential problem of managing a difficult intubation during surgery.
2. An elective caesarean section under neuraxial anaesthesia. The risk of intraoperative conversion to general anaesthesia would likely be less than for an emergency case but in the context of a person with a history of local anaesthetic insensitivity this risk was uncertain but likely to be greater than 0.5% as reported by Kinsella.[2] As with option 1, it would be challenging to undertake a difficult intubation during surgery. Choosing an elective caesarean section would have implications for future pregnancies in a young woman.
3. An elective caesarean section under general anaesthesia following an awake nasal fibreoptic intubation. The previous awake fibreoptic intubations had been difficult and this approach may be uncomfortable or unpleasant for the patient. In addition the woman would be unconscious for the delivery of her baby and establishing bonding may be delayed.

There were no published evidence-based guidelines available to guide decision-making for this particular situation. To inform our decision-making we undertook a literature review. A search on the effect of JHS on mode of delivery identified only one retrospective study. Castori et al.[3] reported that among women with JHS seen at tertiary specialist clinics in the USA, 72% had a normal vaginal delivery, 6% had an assisted vaginal delivery and 22% had a caesarean section. At our hospital in the previous two years, the percentage of women who had a normal vaginal delivery was 61%, assisted vaginal delivery 12% and caesarean section 27%. The percentage of women who required a category 1 caesarean section was 5%.

Published data suggest that the failure rate of epidural analgesia extended for anaesthesia for a category 1 emergency caesarean section is about 24% whilst the failure rate of spinal anaesthesia is about 8%.[2]

There is also little information available on the efficacy of labour epidural analgesia for women with JHS. There have been published case reports of successful spinal anaesthesia for caesarean section in six patients with Ehlers-Danlos,[4–8] and three case reports of epidural analgesia/anaesthesia which failed for two patients and was successful for one.[9–11]

In the absence of evidence-based guidelines or clear evidence from the published literature to guide decision making, opinion was sought from other consultant obstetric anaesthetists working in our hospital. The consensus was to advise delivery by elective caesarean section under general anaesthesia following an awake fibreoptic intubation. This consensus opinion was discussed with the obstetricians who supported the anaesthetic opinion but it was acknowledged that there was no other indication for caesarean section other than our anaesthetic concerns. It was also acknowledged there would be implications for future pregnancies and deliveries for a young woman who had an elective caesarean section for her first delivery.

The woman accepted the advice and had an elective caesarean section under general anaesthesia with an awake nasal fibreoptic intubation. There were two consultant anaesthetists present and an otorhinolaryngology surgeon on standby. The anaesthetic technique involved inserting a lumbar epidural catheter for postoperative analgesia before intubation and induction. The epidural insertion was uneventful. For the awake intubation, intravenous glycopyrrolate was administered as an antisialagogue and topical phenylephrine nasal spray applied to one nostril. 4% Lidocaine in 2 mL doses was applied by spray to the nasal passages and the oropharynx. A flexible fibreoptic scope was inserted nasally and two further 2 mL doses of 4% lidocaine were given through the scope using an epidural catheter inserted in the scope's suction channel as the scope was advanced into the larynx. Patient tolerance to the procedure was assisted by small intravenous doses of propofol and fentanyl.

Following successful intubation anaesthesia was induced with propofol and fentanyl with atracurium for neuromuscular blockade. Anaesthesia was maintained with isoflurane in oxygen and air. During the operation, local anaesthetic (0.25% levobupivacaine 18 mL) was administered in incremental doses through the epidural for postoperative analgesia. Epidural diamorphine 3 mg was also given. Anaesthesia and surgery were uneventful with an estimated blood loss measured as 300 mL. A baby girl was delivered whose Apgar scores were 4, 9 and 10 at 1, 5 and 10 min, respectively. The woman went home with her baby on the second postnatal day. With regards to her history of local anaesthetic insensitivity, the woman tolerated the fibreoptic intubation under local