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Volume 1 • Issue 1 • 2022

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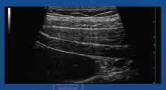

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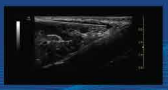

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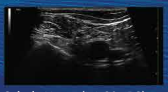

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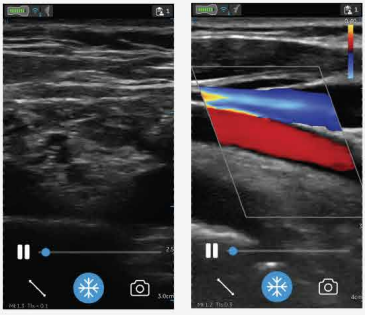

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Malaysian Journal of Anaesthesiology

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Malaysian Journal of Anaesthesiology (MyJA) is an official journal of the Malaysian Society of Anaesthesiologists and College of Anaesthesiologists, Academy of Medicine Malaysia. MyJA is an English-language, peer-reviewed journal that publishes articles in the fields of anaesthesiology, critical care, and pain medicine.

MyJA aims to provide a platform for anaesthesiologists, clinicians, researchers, and trainees in Malaysia to publish high-quality clinical and scientific materials on all aspects of anaesthesiology, critical care, and pain medicine. It also welcomes submissions from researchers all over the world. In addition to publishing original articles (clinical trials, experimental research, meta-analysis, and systematic reviews), MyJA also features reviews, case reports and case series, and letters to the editor. The primary considerations for publication are clarity, uniqueness, scientific rigor, and advancement in design, performance, and knowledge.

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ISSN
Online: pending
Print: 2772-9524

Publisher
Kugler Publications
P.O. Box 20538
1001 NM Amsterdam
The Netherlands
info@kuglerpublications.com
www.kuglerpublications.com
Published for Malaysian Society of Anaesthesiologists and College of Anaesthesiologists.

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Editorial
https://doi.org/10.35119/myja.v1i1.25

Transitioning into the post-pandemic era in anaesthesia: a reflection of lessons learnt

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The recent COVID-19 pandemic has significantly impacted the country's anaesthesia and critical care services. Cancellation and postponement of elective surgical cases to curb the spread of infection and redeployment of manpower plus resources for the creation of critical care beds were our main focus.[1] The subsequent human resource challenge to safely staff the beds and the psychological stress suffered by providers due to the hazardous nature of the work dominated the thrust of the administrators during the full force of the pandemic.

Anaesthesiologists at the forefront of safety saw to a rapid proliferation of guidelines produced in record time by our fraternity to protect ourselves and our patients from being infected by the SARS-CoV-2 virus. The Malaysian Society of Anaesthesiologists and College of Anaesthesiologists, Academy of Medicine Malaysia (MSA/CoA, AM) produced recommendations on the appropriate protection during aerosol-generating procedures (AGPs), including the use of powered air-purifying respirators whenever available.2 Being a precious commodity during the pandemic, the safety of the anaesthesiologist became a priority. Even in the event of a deteriorating COVID-19 patient, the anaesthesiologist was advised to don full personal protection equipment (PPE) before attending to the patient.

Successful intubation at the first attempt has never been more critical. It became obvious that anaesthesiologists could not change the circumstances, but still had

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the undeniable responsibility of saving a patient's life, so we needed to adapt. Video laryngoscope usage increased manifold following the recommendation of airway management policies of many Difficult Airway Societies across the world.[3,4] Training our staff in proper donning and doffing of PPE was vital and had to be conducted swiftly during procedures.[5]

Regional anaesthesia, namely central neuraxial or peripheral nerve blocks, was recommended as the technique of choice whenever appropriate to avoid AGPs.[6] It is unclear whether the recommendation has resulted in an increased percentage of regional anaesthesia during the pandemic. However, anaesthesiologists felt safer by avoiding AGPs whenever there was a choice regarding the type of anaesthesia.

It also became obvious to the medical fraternity at large how important the skill sets of anaesthesiologists were in this pandemic. In the face of shortage of intensivists, anaesthesiologists filled in rapidly to care for critically ill COVID-19 patients. The clarification of clinical skills possessed by future anaesthesiologists must be delineated, as we are seen to be equally adaptable to caring for patients in the operating theatre, intensive care unit, or even in the emergency department.[7] The government must therefore plan to train increasing numbers of anaesthesiologists in the future.

From the COVID-19 experience we learned that infection control practices amongst health professionals made a huge difference. Anaesthesiologists are more compliant with hand hygiene, show greater adherence to proper use of N95 masks, practice stringent donning and doffing of PPEs, and plan intubation and ventilation of COVID-19 patients better than most providers from other disciplines.[8] As a result, hospital-acquired infections showed a declining trend; this was definitely a step in the right direction in exemplary behaviour.[9]

Dissemination of information and knowledge has rapidly evolved. It was beyond imagination that academicians, clinicians, and researchers across the world rose to the occasion: communicating and exchanging useful, much needed knowledge virtually and seamlessly. Although this has reached new heights in knowledge transfer, the physical interaction prevalent in the pre-COVID-19 era is missed and still preferred by many.

As we progress into the endemic phase, the dilemma of when a post-COVID-19 patient can undergo elective surgery has surfaced. Following consensus from international guidelines, MSA/CoA, AM recommended a minimum 7-week waiting period after COVID-19 infection for elective surgical cases.[10] In addition, rehabilitation of post-ICU patients has become more relevant as we treat post-COVID-19 infection patients longer in ICU. Hence, a multidisciplinary approach to treating

the patient recovering from COVID-19 is essential to maximally integrate resources for the best outcome.

The COVID-19 pandemic has impacted our lives in many ways; many developed a greater appreciation for life. Tsan *et al.* showed that the burnout rate among anaesthesiologists in Malaysia was very high.[11] We are reminded to focus on our lives and that of our colleagues as we push to save the lives of our patients. The MSA/CoA, along with its Wellness Special interest group, has actively promoted wellness among the anaesthesia fraternity, as it is truly #Kitajagakita. We hope that with the transition to the endemic stage of the pandemic, our fraternity will come out stronger and wiser, assimilating the lessons learnt from our collaboration. This will ensure a stronger team of anaesthesiologists with a brighter future for our discipline.

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© Malaysian Journal of Anaesthesiology 2022; 1:11
Editorial
https://doi.org/10.35119/myja.v1i1.27

Message from the Chief Editor

We celebrate the launch of Malaysian Journal of Anaesthesiology (MyJA) with profound pleasure, humility, and anticipation. On behalf of the MyJA editorial team, I would like to extend a warm welcome to our readership. I take this opportunity to thank our esteemed authors, editors, and reviewers, all of whom have volunteered to contribute to our journal's success.

MyJA aims to provide a platform for local anaesthesiologists to engage in academic writing. We believe our local fraternity has a vast untapped talent to contribute to the body of knowledge in anaesthesia, critical care, and pain medicine. We also welcome submissions from anaesthesiologists abroad to foster collaborative research and improve the quality of care we provide to our patients.

MyJA will be published biannually, featuring original articles, review articles, case reports and case series, and last but not least, letters to the editor. In this first edition, MyJA showcases two original articles on the role of magnesium sulphate as a pretreatment to obtund fentanyl-induced cough during general anaesthesia, and the role of Ambu® AuraGain™ as a conduit for intubation in children. The featured case reports touch upon a variety of interesting subjects ranging from awake craniotomy to atypical presentation of renal carcinoma, from which we hope our readers will glean useful clinical insights. Finally, we offer our readers the chance to test their knowledge with our Anaesthe-quiz, for which there will be prizes.

Launching our very own journal is a massive step for our fraternity in Malaysia. We are delighted that you are joining us as readers and we certainly hope you will be joining us as contributors in our future issues. Together we will strive to make MyJA a renowned journal in anaesthesia, critical care, and pain medicine worldwide.

Prof. Dr. Ina Ismiarti Shariffuddin

Chief Editor

Malaysian Journal of Anaesthesiology

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Original article
https://doi.org/10.35119/myja.v1i1.12

Magnesium sulphate pretreatment obtunds fentanyl-induced cough during general anaesthesia induction

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Abstract

Introduction: Fentanyl-induced cough is common during induction of general anaesthesia. This unpleasant cough may increase the intraocular, intracranial, and intraabdominal pressure. We hypothesised that 30 mg/kg of prophylactic intravenous magnesium sulphate is effective in obtunding 2 µg/kg fentanyl-induced cough.
Methods: One hundred and forty patients scheduled for general anaesthesia, aged between 18 to 70 years old with American Society of Anesthesiologists physical status I were randomised into two groups. Group I and Group II patients received 30 mg/kg intravenous magnesium sulphate and normal saline, respectively. The solution studied was infused over 15 minutes followed by a fentanyl bolus 2 µg/kg delivered within 3 seconds. The incidence of cough and severity were documented. Mean arterial pressure and heart rate were recorded every 5 minutes during the infusion.
Results: Eight patients (11.4%) had cough in Group II and one (1.4%) in Group I. Compared to Group II, the incidence and severity of cough were significantly lower in Group I (p = 0.003 and p = 0.037), respectively. There was no significant

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difference regarding the haemodynamic status between the two groups during the infusion of both solutions.
Conclusion: During general anaesthesia induction, 30 mg/kg of intravenous magnesium sulphate effectively obtunded fentanyl-induced cough.

Keywords: cough, fentanyl, general anaesthesia, magnesium sulphate

Introduction

Fentanyl is a rapid-onset opioid used to assist in the production of loss of consciousness and to obtund the sympathetic nervous system during the intubation process.[1,2] However, one of its side effects during general anaesthesia induction is fentanyl-induced cough, ranging from 6.6% to 61.0%, depending on the dose and speed of injection.[3] A typical induction dose of 2 μg/kg was reported to produce a fentanyl-induced cough in 38% of patients.[4]

Coughing can cause wide fluctuations of intrathoracic pressure, which stimulates the reflex activation of the sympathetic nervous system leading to stress on the cardiovascular system.[5] This effect could be detrimental in patients who suffer from hypertension, ischaemic heart disease, heart failure, high intraocular pressure, or intracerebral bleed.[3]

A few drugs have been shown to suppress fentanyl-induced cough, such as lidocaine, ketamine and dexmedetomidine.[6-8] Magnesium sulphate 30 mg/kg was proven effective in obtunding cough due to fentanyl 5 μg/kg, which is a very high dose.[9] A dose of 20 mg/kg of magnesium sulphate was not statistically significant in reducing the incidence of such cough with fentanyl 2 μg/kg.[4] Hence, we decided to study the effectiveness of 30 mg/kg of magnesium sulphate in obtunding 2 μg/kg fentanyl-induced cough.

Methods

This prospective, double-blind randomised clinical trial was approved by the departmental Research Committee and the Research Ethics Committee of our institute (FF-2018-656). Within a period of 1 year, 140 patients scheduled for general anaesthesia, aged between 18 to 70 years old with American Society of Anesthesiologists (ASA) physical status I were recruited. Any patients with a known allergy to magnesium sulphate, chronic cough, history of upper respiratory tract infection during the previous 4 weeks, or any history of chronic administration of antitussive medication, opioids, or steroids were excluded. Written informed consent was

obtained from all patients, who were fasted preoperatively for a minimum of 6 and 2 hours for solids and clear fluids, respectively. Premedication was not prescribed to all patients. Prior to general anaesthesia induction, standard ASA monitoring including 3-lead electrocardiogram, non-invasive blood pressure monitoring, and arterial oxygen saturation was applied, and intravenous access was established.

The patients were randomised into two groups using the allocation concealment mechanism. Prior to administration of 2 µg/kg fentanyl for general anaesthesia induction, Group I patients received 30 mg/kg of intravenous magnesium sulphate diluted to a volume of 20 ml with normal saline, whereas Group II patients received 20 ml of normal saline. The investigator prepared the syringes containing either of the above solutions, while the anaesthetists who performed the cough assessments and the patients were blinded to the content of the solution. The randomised study drug was given intravenously via the T-connector of the peripheral intravenous access over 15 minutes using a syringe pump. Before commencing the infusion, the patients were asked to inform if there was presence of pain, discomfort, or none at the infusion site.

Upon near completion of the solution delivery, all patients were preoxygenated with 100% oxygen as per the usual protocol. One minute after the completion of the infusion, 2 µg/kg of fentanyl was given over a period of 3 seconds through the same route. The incidence and severity of the cough were then assessed within a period of 1 minute after the administration of fentanyl using a standard stopwatch. The scoring of severity of the cough was based on the following four-point scale: Grade 0: no cough (none); Grade 1: single cough (mild); Grade 2: more than one attack of non-sustained cough (moderate); and Grade 3: repeated and sustained coughing with head lift (severe).[4]

One minute following fentanyl administration, general anaesthesia was induced with 2–3 mg/kg of propofol. General anaesthesia was then maintained with sevoflurane with a minimum alveolar concentration of 1.0–1.2 in an oxygen/air mixture. The airway management was at the discretion of the attending doctor.

Haemodynamic status of mean arterial pressure (MAP) and heart rate (HR) were documented at the time of initiation of magnesium sulphate infusion (T_0), every 5 minutes until the completion of infusion (T_1, T_2, and T_3) and immediately after administration of fentanyl (T_4). Any episodes of hypotension (MAP < 20% of baseline) or bradycardia (HR < 45/min) was treated with boluses of intravenous phenylephrine 50 µg or intravenous atropine 0.5 mg, respectively. Any intolerable pain at the infusion site or persistent hypotension and bradycardia despite treatment that resulted in discontinuation of magnesium sulphate infusion was considered as dropped out.

By using the Fleiss formula,[9] the sample size calculation was determined based on a study by Liu *et al.*[10] A total of 140 patients (70 patients for each group) was required to provide the study with a power of 95% and significance level of 5% while allowing a 10% dropout rate. All data analysis was performed using SPSS for Windows version 23.0 (IBM Corp, Armonk, NY, USA). Results were presented as mean ± standard deviation or frequency (percentage) where appropriate. For inter-group analysis, repeated measure ANOVA with post-hoc Bonferroni test was used. The qualitative data were analysed using Pearson's chi-square or Fisher's exact test if the assumption was not met. A p-value of < 0.05 was considered statistically significant.

Results

A total of 140 patients participated in this study with no dropouts. There were no significant differences in terms of demographic data between the two groups, as shown in Table 1.

Table 2 shows a significantly higher incidence of fentanyl-induced cough in Group II compared to Group I ($p < 0.05$). However, there was no significant difference in the severity of fentanyl-induced cough between the two groups.

There was no significant difference in MAP and HR between the two groups at the different time points during the study drug infusion ($p > 0.05$), as seen in Table 3. Further analysis within each group revealed a statistically significant difference in MAP when T_0 was compared to T_4 ($p = 0.005$) in Group I.

The haemodynamic status of patients in Group II was compared between those who developed fentanyl-induced cough and those who had no cough. There were no significant differences in the MAP and HR ($p > 0.05$), as seen in Table 4.

Table 1. Demographic data

Variable	Group I (*n* = 70)	Group II (*n* = 70)	*p*-value
Age (year)	42.1 ± 14.8	42.8 ± 16.0	0.793[a]
BMI (kg/m^2)	23.8 ± 3.4	23.6 ± 3.0	0.752[a]
Gender			
Male	21 (30.0)	29 (41.4)	0.158[b]
Female	49 (70.0)	41 (58.6)	
Race			
Malay	46 (65.7)	49 (70.0)	0.335[c]
Chinese	18 (25.7)	12 (17.1)	
Indian	2 (2.9)	6 (8.6)	
Other	4 (5.7)	3 (4.3)	

Data expressed in mean ± standard deviation or frequency (percentage) as appropriate.

BMI: body mass index; a: independent T test; b: Pearson's chi-square; c: Fisher's exact test

Table 2. Incidence of discomfort or pain at infusion site, and incidence and severity of fentanyl-induced cough

Variable	Group I (*n* = 70)	Group II (*n* = 70)	*p*-value
Number of patients with discomfort or pain at infusion site	3 (4.3)	0 (0)	0.245[c]
Number of patients who coughed	1 (1.4)	8 (11.4)	*0.033[c]
Severity of cough			
Mild	1 (1.4)	6 (8.6)	0.059[c]
Moderate	0 (0)	1 (1.4)	
Severe	0 (0)	1 (1.4)	

Data expressed as numbers (percentages).

c: Fisher's exact test, *$p < 0.05$

Table 3. Haemodynamic status of both groups during solution infusion

Variable	Group I (*n* = 70)	Group II (*n* = 70)	*p*-value
MAP (mmHg)			
T_0	98.0 ± 16.3	98.9 ± 15.0	0.738[a]
T_1	96.1 ± 16.5	95.7 ± 13.4	0.849[a]
T_2	94.2 ± 15.6	94.6 ± 14.8	0.850[a]
T_3	92.7 ± 16.2[d]	95.0 ± 12.2	0.354[a]
HR (beats/min)			
T_0	82.6 ± 16.9	79.4 ± 15.2	0.237[a]
T_1	83.0 ±16.8	79.4 ±14.1	0.173[a]
T_2	84.7 ± 17.3	79.4 ± 15.5	0.058[a]
T_3	83.3 ± 16.7	79.3 ± 14.5	0.138[a]

Data expressed in mean ± standard deviation.

MAP: mean arterial pressure; HR: heart rate; a: independent T-test; d: repeated measure ANOVA with post-hoc Bonferroni test

Table 4. Haemodynamic status during fentanyl-induced cough in Group II

Variable	Cough present (*n* = 8)	Cough absent (*n* = 62)	*p*-value
MAP (mmHg)	97.5 ± 19.9	95.5 ± 18.2	0.768[a]
HR (beats/min)	79.3 ±19.9	80.1 ± 17.2	0.558[a]

Data expressed in mean ± standard deviation.

MAP: mean arterial pressure; HR: heart rate; a: independent T-test

Discussion

The exact mechanism of fentanyl-induced cough is still unknown with several hypotheses proposed.[3] One of them suggested that fentanyl activates the μ opioid receptor, which then stimulates the rapidly adapting receptors present on the mucosa of the proximal tracheobronchial airway, causing bronchoconstriction and cough.[3,11] Another hypothesis suggests fentanyl inhibits central sympathetic outflow which stimulates the vagus nerve, producing bronchoconstriction and cough.[3] Therefore, the role of magnesium sulphate in obtunding fentanyl-induced cough was investigated in clinical trials based on its properties as a calcium antagonist and smooth muscle relaxant.[12,13]

In this study, the incidence of fentanyl-induced cough in the control group was 11.4%, where the dose of fentanyl was 2 μg/kg delivered over 3 seconds. The incidence of fentanyl-induced cough differs according to the patient's age group, fentanyl dosage, and the speed of fentanyl administration.[3] Han *et al.* demonstrated an incidence of 46.3% of fentanyl-induced cough in children after administration of 1 μg/kg fentanyl, whereas with the same dose, Iida *et al.* reported an incidence of only 6.6% in the adult population.[14,15] For a typical induction dose of 2 μg/kg fentanyl, Golmohammadi *et al.* found the incidence of fentanyl-induced cough to be 54.5% in children compared to 11.4% of the adults in this study.[6] Iida *et al.* also reported that a higher dose of fentanyl increased the incidence of cough from 6.6% to 22.5% in relation to 1 μg/kg and 3 μg/kg of fentanyl, respectively.[15] The speed of fentanyl injection has also been shown to influence the incidence of fentanyl-induced cough, which was 18%, 8%, and 1.3% when 2 μg/kg of fentanyl was injected over 2, 15, and 30 seconds, respectively.[16] On the other hand, Schäpermeier and Hopf found no difference in the incidence of fentanyl-induced cough when the study drug was injected over 2, 5, and 10 seconds.[17]

This study demonstrated that 30 mg/kg of intravenous magnesium sulphate could significantly reduce fentanyl-induced cough incidence during induction of general anaesthesia. This is supported by the result of a study conducted by El Motlb *et al.* in which a higher dose of magnesium sulphate was recommended in view that a dose of intravenous 20 mg/kg of magnesium sulphate produced a non-significant reduction in the incidence of fentanyl-induced cough.[4] Although 30 mg/kg of magnesium sulphate significantly reduced the incidence of fentanyl-induced cough, the severity was not statistically significant in both groups when such cough occurred, similar to a study by Liu *et al.*[10] Liu *et al.* also found significantly less incidence of fentanyl-induced cough with 50 mg/kg compared to 30 mg/kg of magnesium sulphate, but a higher dose of 5 μg/kg fentanyl was utilised in their study.[10]

Only three out of 140 patients experienced discomfort or pain at the infusion site. This finding was likely due to a relatively lower dose of magnesium sulphate compared to a study by Park *et al.* where 15.7% of patients experienced a burning sensation in the veins when they received 50 mg/kg of intravenous magnesium sulphate.[18] Similar to this study, Liu *et al.* found that three patients experienced a burning sensation during the injection of 50 mg/kg magnesium sulphate compared to none when receiving 30 mg/kg magnesium sulphate.[10]

Magnesium sulphate is widely used as a vasodilator due to its calcium antagonist property, producing hypotension.[19] However, in this study, there was no significant difference in MAP and HR between the two groups. Although there was a statistically significant reduction of MAP among the patients who received magnesium sulphate, this was within 20% of the baseline and required no medical intervention. This response was probably due to the usage of a lower dose of magnesium sulphate, similar to the result demonstrated by Panda *et al.*, in which there was a significant dose-dependent decrease in MAP requiring intervention in patients who received 40 and 50 mg/kg of intravenous magnesium sulphate as compared to those who received 30 mg/kg of magnesium sulphate.[20] Juibari *et al.* also reported a non-significant difference in blood pressure and HR between those who received 30 mg/kg magnesium sulphate and those who received saline.[21] Mroczek *et al.* reported that magnesium sulphate reduced blood pressure by a greater degree in the hypertensive population as it caused a greater decrease in peripheral resistance compared to the normotensive population.[22] This supported the results in this study as the subjects were all in ASA class I.

A cough could generate a large intrathoracic pressure fluctuation, resulting in increased blood pressure during the intra-cough phase compared to the pre-cough phase.[5,23] However, in this study, the haemodynamic status was insignificant between those who developed fentanyl-induced cough compared to those who had no cough. The limitation of this study was that non-invasive blood pressure was used for MAP monitoring. Apart from not having beat-to-beat monitoring, the time taken for cuff inflation and deflation could potentially miss the detection of significant haemodynamic changes during a fentanyl-induced cough. Thus, invasive monitoring of MAP is recommended for future studies.

Conclusion

In conclusion, during general anaesthesia induction, 30 mg/kg of intravenous magnesium sulphate effectively obtunded 2 μ/kg fentanyl-induced cough.

Declarations

Ethics approval and consent to participate
This prospective, double-blind, randomised clinical trial was approved by the departmental Research Committee and the Research Ethics Committee of our institute (FF-2018-656). Written informed consent was obtained from all patients prior to enrolment.

Competing interests
The authors declare that they have no conflicts of interest.

Funding
Funding of this study was provided by Universiti Kebangsaan Malaysia (FF-2018-656).

Acknowledgements
The authors wish to acknowledge all those involved in data collection and research officer Puan Qurratu Aini Musthafa for her contribution in data analysis.

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© Malaysian Journal of Anaesthesiology 2022; 1:23-31
Original article
https://doi.org/10.35119/myja.v1i1.13

Clinical evaluation of Ambu® AuraGain™ as a conduit for intubation in paediatric patients: a descriptive study

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Abstract

Introduction: Many paediatric difficult airway guidelines have recommended supraglottic airway devices (SGAs) as an indispensable tool in the algorithm for managing failed intubation scenarios. It is used for maintaining ventilation in a difficult or failed intubation. The newer generation SGAs can be used as intubating conduits in patients with a difficult airway. The aim of this study was to report the efficacy and safety of Ambu® AuraGain™(Ambu A/S, Ballerup, Denmark) as a conduit for intubation in paediatric patients.
Methods: Local ethics approval and informed consent was obtained before patient enrolment. Sixteen patients aged 3–12 years old were recruited. Following the induction of anaesthesia and insertion of the Ambu AuraGain, flexible airway scope guided intubation was performed via the SGA. The primary outcome was the time taken for successful tracheal intubation. Secondary outcomes included the number of attempts and the time required for insertion and removal of Ambu AuraGain, oropharyngeal leak pressures, fibre optic grading of glottic views, and complications from the intubation.
Results: The overall success rate concerning intubation was 87.5% (14 patients), with a mean intubation time of 57.0 ± 39.4 seconds. Successful first attempt intubations

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were achieved in 13 patients (81.3%). The results showed easy removal of the Ambu AuraGain device with a mean SGA removal time of 27.2 ± 19.8 seconds. No significant complications occurred throughout the study.
Conclusion: The Ambu AuraGain device can be considered safe and effective as a conduit for intubation in paediatric patients.

Keywords: Ambu AuraGain, intubation, paediatric airway, supraglottic airway

Introduction

Management of a difficult airway in paediatrics is essential in anaesthesia. The latest American Society of Anaesthesiologists (ASA) guidelines in 2013 for managing difficult airway place supraglottic airway devices (SGAs) as an indispensable tool in the algorithm of managing failed intubation scenarios.[1] The Difficult Airway Society in 2015 and All India Difficult Airway Society Guidelines in 2016 published similar algorithms emphasising the use of SGAs.[2,3] The central approach in these guidelines is the utilisation of the SGA to maintain oxygenation and ventilation while deciding the course of action based on the patients and surgery factors.

The Ambu® AuraGain™ (Ambu A/S, Ballerup, Denmark) is one of the intubating SGAs commonly available. A recent study by Jagannathan *et al.* that evaluated the efficacy of Ambu AuraGain as a SGA in children showed positive results.[4] In addition, they demonstrated good fibreoptic views of the larynx, which may suggest a possible use of Ambu AuraGain as an intubating device. However, clinical evaluation of Ambu AuraGain as an intubating device in children has not been studied. The efficacy of Ambu AuraGain for intubation in adults was shown to have a success rate of 91%, with 88% first attempt success.[5]

Therefore, this pilot study aims to report the efficacy of the Ambu AuraGain as an intubating device in children. This study will provide information on the feasibility of using Ambu AuraGain as a conduit to secure the airway in children, especially in a difficult intubation situation.

Methods

This study was conducted at University Malaya Medical Centre between October 2019 and March 2020. Ethical approval was obtained from the Medical Research Ethics Committee, University Malaya Medical Centre (Ethics approval number: 2019226-7174). This study was also registered with Clinicaltrials.gov, NCT03955094. Written informed consent was obtained from the parents or guardians before patient enrolment.

We recruited 16 ASA I-II paediatric patients aged 3–12 years who were scheduled for elective surgery that was amenable to standard endotracheal intubation. Exclusion criteria included a history or clinical features of difficult airway, syndromic patients, and facial or dental deformities. We also excluded patients with recent (less than 2 weeks) or ongoing upper respiratory tract infections, existing pulmonary diseases or any risk of bronchospasm, pulmonary aspiration, or operations requiring specialised endotracheal tubes (ETTs). Two study investigators were involved in this study and performed the intubations. They had more than 10 years of experience each in the field of anaesthesia and had used the Ambu AuraGain SGA at least 20 times on normal airways, and thus were considered experienced users.

Patients were fasted for at least 6 hours before the surgery. All patients were preoxygenated with 100% oxygen for a minimum of 3 minutes. They were induced with intravenous (IV) induction with IV fentanyl 1 µg/kg and IV propofol 3–5 mg/kg or inhalational induction using sevoflurane 8% in 100% oxygen. Neuromuscular relaxation was achieved with IV atracurium 0.5 mg/kg. Anaesthesia was then maintained with sevoflurane to achieve a targeted age-appropriate minimum alveolar concentration of 1.0–1.2. Standard monitoring, which includes non-invasive blood pressure and heart rate measurement, pulse oximetry, and three-lead electrocardiography, was instituted throughout the surgery.

A weight-appropriate Ambu AuraGain was then inserted. Three sizes of SGA were available for this study; size #2, size #2.5, and size #3 with a (manufacturer recommended weight 10–20, 20–30, and 30–50 kg, respectively). Time for the successful placement of SGA was defined as the time of insertion at the oral cavity to the time of detection of square wave capnography with adequate tidal volumes (more than 6 ml/kg). The oropharyngeal leak pressure (OLP) test was performed by closing the adjustable pressure-limiting valve to 40 cmH_2O and setting the fresh gas flow rate to 3 L/min. The OLP was the airway pressure when the peak airway pressure stabilised, and an audible leak was detected.

The size of the Portex® ETT (Smiths Medical, Minneapolis, MN, USA) was chosen based on the patient's age and the manufacturer's recommendation of maximum ETT size for the corresponding Ambu AuraGain. For Ambu AuraGain mask sizes #2, #2.5, and #3, the maximum ETT sizes were 5.0 mm, 5.5 mm, and 6.5 mm, respectively. A cuffed ETT was used for patients more than 6 years old and uncuffed ETT was used for patients younger than 6 years. An appropriately sized ETT was loaded onto a 4-mm Karl Storz® paediatric flexible intubation video endoscope (Karl Storz SE & Co. KG , Tuttlingen, Germany) and then was inserted into the SGA's ventilating orifice until the glottis was visualised. Grading of the glottic view was documented using the system proposed by Brimacombe and Berry as listed below:[6]

- Grade 4: only vocal cords seen.
- Grade 3: vocal cords plus posterior epiglottis seen.
- Grade 2: vocal cords plus anterior epiglottis seen.
- Grade 1: vocal cords not seen, but function adequate.
- Grade 0: failure to function where vocal cords not seen fibre-optically.

Grades 2–4 are considered favourable views; poor glottic views are defined as Grades 0–1.

The scope was advanced past through the vocal cord until visualisation of the carina. In case of poor glottic view (Grade 0 and Grade 1), SGA corrective manoeuvres, such as jaw thrust or jaw lifting, was performed to improve the glottic view. If the glottic view remained poor, the SGA would be removed, and the glottic view would be re-examined. Up to two SGA insertion attempts were allowed; further attempts were considered a failed SGA insertion. The rescue measure taken to secure the airway for the failed intubation via SGA method, was left to the discretion of the anaesthetist in charge of the case.

The investigators then railroaded the ETT into the trachea and confirmed ETT placement with bilateral breath sounds on auscultation and a positive square wave capnograph tracing. Two attempts for intubation through the SGA were allowed; otherwise, the procedure was abandoned. One minute of preoxygenation was allowed between intubation attempts if two intubation attempts were required. The time of intubation attempt was defined as the time from the disconnection of the breathing circuit to the time capnograph tracing was detected. If two attempts were required, the 1-minute interval time required for oxygenation would be subtracted from the total time taken for intubation.

After confirmation of the ETT placement, the investigators disconnected the breathing circuit, deflated the SGA cuff, and removed the SGA while maintaining ETT in situ. ETT dislodgement during SGA removal was considered a failed

intubation attempt. The timing of SGA removal was defined as the time from the disconnection of the breathing circuit to the reconnection of the breathing circuit after SGA removal. Blood stains on the SGA device or in the oral cavity were documented as none, minimal, or large.

During the intubation process, any complications, including desaturation (SpO_2 < 90%), bronchospasm, laryngospasm, bradycardia, and aspiration were treated accordingly and documented.

Data processing and statistics

The calculated sample size for this study was 41 patients over a period of 1 year based on the Cochran formula for sample size calculation. However, in view that this was a pilot study, we only we only recruited 16 paediatric patients. Data entry and analysis were performed using Microsoft Excel 365. Continuous data were presented as mean ± standard deviation (SD), and categorical data were presented as counts and percentages.

Results

A total of 16 patients were recruited. The patients' demographic data and the placement characteristics for Ambu Auragain and endotracheal intubation are depicted in Table 1.

Table 1. Demographic data and descriptive statistics regarding placement and tracheal intubation through Ambu AuraGain

Variables	**Patients (*n* = 16)**
Gender	
Male	12 (75.0)
Female	4 (25.0)
Age (years)	6.5 ± 3.5
Weight (kg)	23.7 ± 12.1
Ambu AuraGain size	
2.0	8 (50.0)
2.5	5 (31.2)
3.0	3 (18.8)

Variables	Patients (*n* = 16)
Ambu AuraGain number of insertion attempts	
1	16 (100.0)
2	0 (0.0)
Ambu AuraGain placement time (seconds)	19.9 ± 6.5
OLP (cmH2O)	23.4 ± 6.0
Number of tracheal intubation attempts	
1	13 (81.3)
2	1 (6.2)
Fail	2 (12.5)
Time for successful tracheal intubation (seconds)	57.0 ± 39.4
Time for successful tracheal intubation (according to glottic view), (seconds)	
Grade 2	63.1 ± 45.3
Grade 3	43.5 ± 6.7
Grade 4	59.4 ± 39.3
Time for Ambu® AuraGain™ removal (seconds)	27.2 ± 19.8

Data expressed as mean ± standard deviation or number (percentage).

All the SGAs were successfully placed on the first attempt and none of the placement attempts required manoeuvres to improve the quality of SGA placement. The glottic views were considered good, with all 16 patients categorised as Grades 2–4.[6] Only one patient required corrective manoeuvres to improve the glottic view from a Grade 1 to a Grade 2.

Two patients had failed intubation via the SGA. The first patient was a 6-year-old child with a Grade 4 glottic view in whom a size 5.0 mm cuffed ETT was not able to be secured via a size 2 SGA after two attempts. The second patient was successfully intubated after two attempts, but the SGA was dislodged during its removal and hence was considered an unsuccessful intubation.

The SGA removals were done in one attempt in all 14 patients, with a mean SGA removal time of 27.2 ± 19.8 seconds. There were minimal blood-stained secretions noted on the SGA device in six of the 16 patients. No other significant complications occurred throughout the study.

Discussion

The use of Ambu AuraGain as an intubation device is feasible and demonstrated satisfactory results as an intubating device, albeit with a slightly lower success rate than other devices reported in previous studies, which were between 90% and 100%.[7-10] This could be due to the study's small sample size, which might not provide a true reflection of its efficacy. Nevertheless, the high percentage of successful first attempt intubations indicated that Ambu AuraGain is a suitable conduit for intubation in paediatric patients.

The intubation time in this study recorded a wide range from 28.0 to 143.3 seconds. A wide range of intubation time was also reflected in several studies.[8,11] However, the mean intubation time recorded in this study was comparable to a previous study by Jagannathan *et al.*[11] The wide range of intubation time may be due to inter-individual patient and operator-dependent factors. Apart from that, the methods by which intubation times are determined vary between different studies, leading to discrepancies in measurement.

One of the issues encountered during the study was the accuracy in determining the suitable size and type of ETT for the patients. For example, in the first patient with a failed intubation attempt, a cuffed 5.0-mm ETT could not pass through the vocal cords despite good glottic visualisation (Grade 4). However, subsequent intubation with direct laryngoscopy was easy with an uncuffed 5.0-mm ETT. On the other hand, three patients with successful intubations had to be reintubated with direct laryngoscopy with larger ETT sizes due to substantial leaking and inability to ventilate adequately with low flow rates.

This study also found that Ambu AuraGain removal after successful intubation was relatively easy, with a mean SGA removal time of 27.2 ± 19.8 seconds. This result is comparable to those in a previous study showing an average SGA removal time of 15.7 ± 5.3 seconds for the Air-Q ™ intubating laryngeal airway (SalterLabs, CA, USA) and 18.0 ± 9.3 seconds for the Ambu® Aura-I™ (Ambu A/S, Ballerup, Denmark).[9] In this study, only one of the 16 patients had the ETT dislodged during the removal process. We postulated that the reason for SGA dislodgement was inadequate lubrication of the ETT and the SGA device before insertion.

Our study showed that Ambu AuraGain was easy to place in all patients with short placement times and optimal device placement as indicated by a good glottic view with corrective manoeuvres to improve placement. Moreover, satisfactory OLP pressures were achieved with the Ambu AuraGain. These results concur with previous studies that have shown Ambu AuraGain as a suitable ventilatory device in paediatrics.[4,12]

Our study has several limitations. Firstly, the sample size of this study was small and the distribution of patients between the three SGA sizes was unequal. Thus, the comparison between the groups was not feasible. However, this study demonstrated that the Ambu AuraGain is useful as an intubating conduit in paediatric patients with a satisfactory success rate. This information is vital, especially in a "can't intubate can't ventilate" clinical scenario. Secondly, as this study was done on patients with normal airways, the use of Ambu AuraGain may not be suitable in patients with features of difficult airway such as limited mouth opening and abnormal pharyngeal anatomy. Further studies comparing the efficacy of Ambu AuraGain with other devices through randomised controlled trials with larger sample sizes would need to be explored.

In conclusion, this study demonstrates a high percentage of successful first attempt intubations via Ambu AuraGain, indicating that it is a suitable conduit for intubation for paediatric patients.

Declarations

Ethics approval and consent to participate
Ethical approval was obtained from the Medical Research Ethics Committee, University Malaya Medical Centre (Ethics approval number: 2019226-7174). Written informed consent was obtained from the parents or guardians before patient enrolment.

Competing interests
None to declare.

Funding
None to declare.

Acknowledgements
None to declare.

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Case series/Case report
https://doi.org/10.35119/myja.v1i1.8

Anaesthetic management of awake craniotomy in a patient with sick sinus syndrome: a case report

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Abstract

Awake craniotomies (AC) have been mainly used in functional neurosurgery, tumour resection in eloquent regions, and epilepsy surgery. However, evidence of the practice of AC for other indications is scarce. Furthermore, there is limited evidence of AC performed on patients with severe comorbidities, especially those with poor cardiorespiratory reserve. We report a successful case of AC on a patient with bilateral acute on chronic subdural haemorrhage with sick sinus syndrome on a permanent pacemaker with multiple other comorbidities presenting for emergency bilateral burr hole and drainage. We were able to achieve a stable haemodynamic profile perioperatively with no untoward complications. The patient had improved neurological outcome immediately postoperatively that eliminated the need for close monitoring in ICU and allowed earlier hospital discharge.

Keywords: awake craniotomy, scalp block, sick sinus syndrome

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Introduction

There is scarce evidence of awake craniotomy (AC) in patients with a poor cardiorespiratory reserve and severe systemic disease. We report the first case of AC for a patient with underlying sick sinus syndrome (SSS) on a permanent pacemaker with multiple comorbidities presenting for emergency bilateral burr hole and drainage of subdural hematoma.

Case presentation

A 64-year-old man with American Society of Anaesthesiologists (ASA) Physical Status Class 3 presented with a history of generalized weakness for 2 weeks and intermittent headache with no prior history of trauma. Glasgow Coma Scale (GCS) on arrival was E4V2M6 (12/15), which dropped to E3V2M5 (10/15) in the ward. Non-contrasted computed tomography of the brain revealed acute on chronic subdural haemorrhage in the fronto-temporo-parietal regions bilaterally. He was posted for bilateral burr hole and drainage of the subdural haemorrhage under the emergency list.

He had been diagnosed with SSS and coronary artery disease for which a percutaneous coronary intervention (PCI) and a drug-eluting stent was placed with subsequent insertion of a permanent dual-chamber pacemaker 10 months prior. He had been on dual antiplatelets (aspirin and clopidogrel) post-PCI. The latest transthoracic echocardiography reported a left ventricular ejection fraction of 42% with no other significant abnormalities. He also had end-stage renal disease on regular haemodialysis, diabetes mellitus type 2, and essential hypertension.

A cardiology consult was obtained, and it was confirmed that the pacemaker was in good function with strong battery life. There was no indication to change to asynchronous mode for the surgery as it was a dual-chamber pacemaker in DDD mode (no rate modulation function) and thus the patient was not pacemaker dependent. This was also evident from the recent electrocardiogram (ECG), which showed sinus rhythm with an intrinsic rate of 65 bpm and no pacing spikes preceding p-waves nor QRS complexes.

On assessment in the operating room, GCS was E4V3M5 (12/15), pupils measured 2 mm bilaterally and were reactive to light, blood pressure (BP) was 127/86 mmHg, and pulse rate was 63 bpm. Oxygen saturation (SpO_2) was 96% on room air with a respiratory rate (RR) of 24 and lung examination revealed bibasal fine crepitations. Blood investigations were unremarkable except for urea of 12 mmol/L, creatinine of 347 μmol/L, and venous blood gas showing HCO_3 of 19.6 mmol/L and base

excess of -3.2. We planned for AC with bilateral anterior scalp block and monitored anaesthesia care (MAC) using target-controlled infusion (TCI) propofol for sedation. Anaesthetic consent was obtained from the family due to his fluctuating GCS status.

He was attached to a standard 5-lead ECG that did not show any pacing spikes intraoperatively. He was also connected to continuous pulse oximetry monitoring and intermittent non-invasive BP monitoring at 5 minutes intervals. Five L/min of oxygen was applied via a simple face mask with continuous capnography monitoring. An 18G intravenous (IV) access was inserted for venous access. Transcutaneous pacing pads were then attached to the patient's chest in the event of pacemaker failure with a defibrillator machine on standby nearby. Emergency drugs and equipment necessary for conversion to general anaesthesia were prepared for standby. Electromagnetic interference during surgery was minimized with the usage of bipolar diathermy.

We employed MAC technique with TCI propofol sedation using effect-site target (Schneider model, Injectomat TIVA Agilia™, Fresenius Kabi, Bad Homburg, Germany) with effect-site concentrations maintained between 0.3 to 0.5 µg/ml. The patient remained sedated with Modified Observer's Assessment of Alertness/Sedation (MOAA/S) score between 2 to 3, SpO_2 above 95%, and RR of 16 to 20. The scalp was cleaned and a scalp block was then performed via aseptic technique. Ropivacaine 0.5% (total concentration 70 mg, 2–3 ml at each site) was used to block supraorbital, supratrochlear, zygomaticotemporal, and auriculotemporal nerves bilaterally which were identified via landmark technique. Further 40 mg of ropivacaine was given to the surgeon to supplement with a field block at incision sites and wetting the burr hole sites. Total ropivacaine dose used did not exceed 3 mg/kg body weight (patient's weight estimated at 55 kg, total dose administered 110 mg). Patient was positioned supine with his head rested on a horseshoe with the bed tilted head up 15°. A tent was created under the surgical drapes to allow visualization and access to the patient. Four units of platelets were transfused to reduce the risk of intraoperative bleeding as the patient had been on dual antiplatelet.

Surgery then proceeded with minimal blood loss and no adverse events. IV fentanyl 10 µg boluses were given prior to scalp block, skin incision, and duratomy as supplemental analgesia (total 40 µg throughout the procedure). Haemodynamics and oxygen saturation were stable with minimal fluctuations throughout the procedure. TCI propofol was stopped at the end of the procedure and the patient regained a GCS of E4V4M6 (14/15) and appeared more alert and communicative. Oxygen was weaned off and SpO_2 remained 98% on room air with a RR of 20 to 24. The patient was later transferred to the Neuro High Dependency Ward for close observation and later discharged home after 2 days.

Discussion

There is limited evidence of the performance of AC in patients with poor cardiorespiratory reserve and significant comorbidities. To date, there have been only a few case reports and case series of AC being safely performed in patients with severe systemic diseases with good perioperative outcomes.[1-3] Evidence of AC in patients with cardiac disease is even more scarce. D'Antico *et al.* reported successful AC and local anaesthesia (LA) infiltration for a patient with unrepaired complex cyanotic congenital heart disease undergoing emergency craniotomy for cerebral abscess.[4] Heifets *et al.* reported performance of AC for recurrent third ventricular colloid cyst in a patient with severe pulmonary arterial hypertension in the setting of Eisenmenger syndrome.[5] Meng *et al.* performed AC with MAC for a young man with non-ischemic four-chamber dilated cardiomyopathy and low-output cardiac failure.[6] These three case reports demonstrated stable haemodynamic profile throughout surgery without much intervention. To date, no literature can be found on AC being performed on patients with SSS on pacemaker.

Many studies have found scalp block to be effective and superior to LA infiltration in blunting haemodynamic and stress responses during craniotomy, specifically during incision, head pinning, and emergence.[7-9] As this patient had SSS on a permanent pacemaker and other significant comorbidities, our main aim was to ensure strict haemodynamic stability and minimize the risk of cardiac arrhythmias. Furthermore, maintenance of stable haemodynamics is of paramount importance to ensure stable cerebral perfusion pressure, as the patient had clinical evidence of increased intracranial pressure due to his fluctuating GCS. Thus, AC with scalp block technique and sedation with TCI propofol was chosen as the main anaesthetic technique over general anaesthesia.

As the patient required bilateral burr holes, a scalp block technique was chosen to enable targeted nerve blockade with the calculated dose of LA not exceeding the maximum allowable dose to avoid the risk of LA toxicity. Ropivacaine was chosen as LA due to its better cardiovascular profile and long duration of effect, which extends to the postoperative period and serves as postoperative analgesia, hence reducing the need for other strong analgesics such as opioids.

Careful titration of sedation was of utmost importance as oversedation may lead to apnoea, hypoxemia, hypercapnia, and cerebral swelling, whereas undersedation may result in agitation, hypertension, and tachycardia. Ultimately, we had to ensure optimal brain relaxation for the surgical evacuation of the subdural haematomas whilst avoiding all the possible complications. Thus, a TCI sedation technique was chosen due to its ease of titratability to achieve the exact plane of sedation without compromising the patient's haemodynamics and avoiding oversedation, especially

as he already had a fluctuating GCS. Propofol was chosen over dexmedetomidine as the sedative agent of choice due to undesirable side effects of the latter, namely bradycardia and hypotension.

A further advantage of AC in this patient was the ability to continuously monitor neurology intraoperatively and prevent neurological deterioration as he had fluctuating GCS. The continuous monitoring of the patient's neurology also allowed earlier detection of possible surgery-related complications such as intracranial or epidural haematoma.[10] The patient's neurology improved immediately post-procedure, allowing for faster hospital discharge on postoperative day 2 and eliminating the need for ICU monitoring postoperatively.

Conclusion

AC with MAC is a useful tool in the armamentarium of anaesthesiologists when faced with patients with serious comorbidities presenting for craniotomy. AC is a safe and reliable technique for patients with SSS, pacemakers, and other significant comorbidities, even when done in the emergency setting. Nevertheless, careful selection of patients based on sound clinical judgment and refined anaesthetic techniques tailored to individual patients is imperative to avoid complications.

Declarations

Informed consent for publication
An informed written consent was obtained from the patient's family prior to anaesthesia for the purpose of this case report write-up and submission.

Competing interests
The authors declare no conflicts of interests.

Funding
None to declare.

Acknowledgements
None to declare.

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© Malaysian Journal of Anaesthesiology 2022; 1:38-44
Case series/Case report
https://doi.org/10.35119/myja.v1i1.15

Airway management of a neurofibromatosis type 2 with multicompartmental tumours: a case report

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Abstract

Neurofibromatosis type 2 (NF2) is a rare autosomal dominant disorder. We report a case of a 52-year-old woman with underlying NF2 who was scheduled for excision of cervical neurofibromas. The patient had four nerve sheath tumours affecting different parts of the airway, namely, two cervical neurofibromas with spinal cord compression, a large retrosternal goitre extending into the anterior mediastinal compartment causing central airway obstruction, and a large left thoracic paravertebral tumour in the posterior mediastinal compartment. After risk stratification and multidisciplinary discussion, awake nasal fibreoptic intubation with a contingency plan of rigid bronchoscopy and jet ventilation was decided. The patient was intubated successfully with target-controlled infusion remifentanil as the sole sedative and airway topicalization with local anaesthetic. The patient was ventilated in a prone position intraoperatively with no desaturation. The tumours were successfully removed and the patient was discharged well. Awake nasal fibreoptic intubation is the choice of management in difficult airways affected by multicompartmental tumours in a centre that is devoid of extracorporeal membrane oxygenation service.

Keywords: airway management, central airway obstruction, mediastinal mass, neurofibromatosis type 2

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Introduction

Neurofibromatosis (NF) is an inherited autosomal dominant neurocutaneous disorder classified into three types: NF1, NF2, and schwannomatosis. NF1 comprises approximately 96% of all cases, while NF2 and schwannomatosis comprise 3% and < 1%, respectively.[1] NF1, also known as von Recklinghausen's disease, is associated with malignant tumours and vascular diseases that significantly contribute to the death of NF1 patients before the age of 40 years. Meanwhile, NF2 predisposes individuals to multiple nervous system tumours.[1] Central airway obstruction (CAO) is a pathological condition that leads to airflow limitation of the trachea, main stem bronchi, bronchus intermedius, or lobar bronchus which may result from intrinsic stenosis or extrinsic compression.[2] We describe a case of CAO in a NF2 patient who presented with complex multicompartmental tumours involving the airway. The patient required excision of the cervical neurofibromas in the prone position, which posed a considerable challenge in anaesthetic management.

Case presentation

A 52-year-old female was diagnosed with NF2 involving the cervical spine, thoracic spine, left elbow, and left lung for the past 13 years and was under neurosurgical team follow-up. The patient opted for conservative management as the tumours did not affect her daily activities. She had bilateral thyroid swelling but was clinically and biochemically euthyroid under conservative management. The patient's hypertension was well controlled with oral hydrochlorothiazide 25 mg once daily. Her body mass index was 25.8 kg/m^2 (weight 58 kg, height 150 cm). Due to progressive right upper limb weakness and bilateral lower limb numbness over the course of 1 month, she agreed to excision of the cervical neurofibromas.

Preoperatively, the patient was comfortable under room air with no obstructive symptoms. Her mouth opening was three fingers wide with a Mallampati score of class I. Range of motion of the neck and thyromental distance were normal. A diffuse neck swelling measuring 7.0 x 5.0 cm, larger on the right side with retrosternal extension and without bruit, was noted. There were no signs suggestive of superior vena cava compression. Indirect laryngoscopy performed by an otorhinolaryngologist in the clinic revealed normal vocal cords. Preoperative laboratory results including full blood count, renal and liver profile, thyroid function test, arterial blood gas, and electrocardiogram were normal. Chest radiography noted a large thyroid mass measuring 6.0 x 6.0 cm with tracheal deviation to the left (Fig. 1). Magnetic resonance imaging of the whole spine revealed four lesions: a lobulated right extradural lesion, extending from C3 to C5, measuring 2.7 x 1.8

x 3.6 cm with adjacent significant cord compression and narrowing of the spinal canal (Fig. 2a); a similar lobulated lesion in the left neural foramen extending into the central canal causing cord compression; a large heterogeneous lesion measuring 9.7 x 9.5 x 13.6 cm at the left thoracic paravertebral region (Fig. 2b, 2c); and a large right thyroid lesion with retrosternal extension measuring 4.2 x 6.6 x 6.8 cm causing CAO, shifting the trachea to the left with significant luminal narrowing of 4.0 mm at the level of C6 and compressing the left bronchus (Fig. 2d).

A comprehensive preoperative multidisciplinary team discussion was carried out among anaesthesiologists, otorhinolaryngologists, neurosurgeons, and radiologists. Awake nasal fibreoptic intubation was planned with an otorhinolaryngologist on standby in the operation theatre to initiate rigid bronchoscopy and jet ventilation if necessary. The airway management plan and risks of difficult airway were explained to the patient, followed by a written informed anaesthetic consent. The patient was fasted for 6 hours before being sent to the operation theatre. Her initial vital signs were stable, with a blood pressure of 115/70 mmHg, heart rate of 90 bpm, and oxygen saturation of 98% under room air. Intravenous (IV) glycopyrrolate 200 µg was given 30 minutes before induction as an anti-sialagogue. The right radial artery was cannulated under local anaesthesia and the patient was put on standard monitoring of blood pressure, electrocardiogram, and pulse oximeter.

The nasal cavity was packed with a 4% cocaine-soaked cotton applied to the left nostril for 10 minutes. It was followed by a combination of nebulised lignocaine 2% (5.0 ml) over 20 minutes and two puffs of lignocaine 10% sprayed onto the bilateral tonsillar pillars and uvula, respectively. The patient was subsequently preoxygenated with 100% oxygen for 5 minutes and oxygenation was continued with nasal prong 3 L/min. Target-controlled infusion (TCI) remifentanil was initiated using the Minto model targeting the effect site at 0.5–1.5 ng/ml, followed by the spray-as-you-go technique during awake fibreoptic bronchoscopy. An aliquot of 2.0 ml lignocaine 2% was sprayed directly onto the epiglottis, arytenoid, and glottis inlet sequentially. A total of 4.8 mg/kg lignocaine was used. No cough was elicited during tracheal intubation with a 6.5-mm armoured endotracheal tube.

General anaesthesia was induced and maintained with TCI propofol using the Marsh model targeting the plasma site at 3.0–4.5 µg/mL and TCI remifentanil 2.0–4.0 ng/mL, guided by Bispectral index monitoring at a value between 40 and 60. The right femoral vein was cannulated with a 7-French triple-lumen catheter. Blood pressure and heart rate were maintained within 15% from baseline after induction and positioning. Saturation was maintained at 100% throughout the surgery. No muscle relaxant was given throughout the operation. The cervical tumours were removed successfully with an estimated blood loss of 300 ml. The

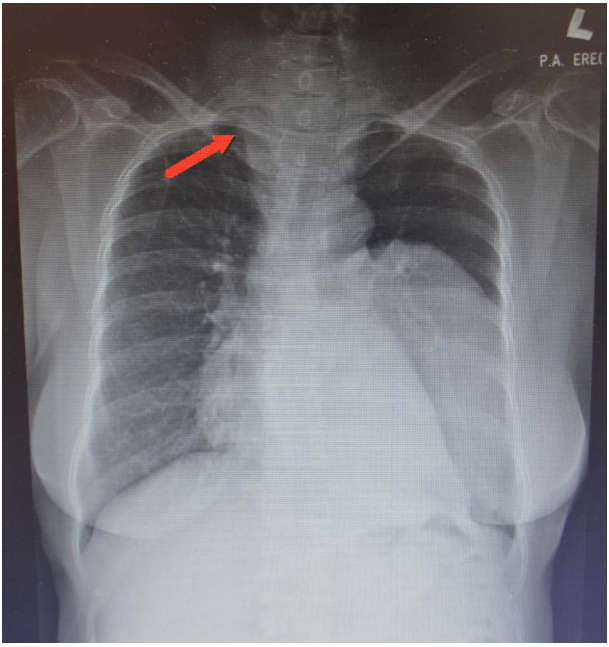

Fig. 1. Chest X-ray showing mediastinal widening with tracheal deviation to the right.

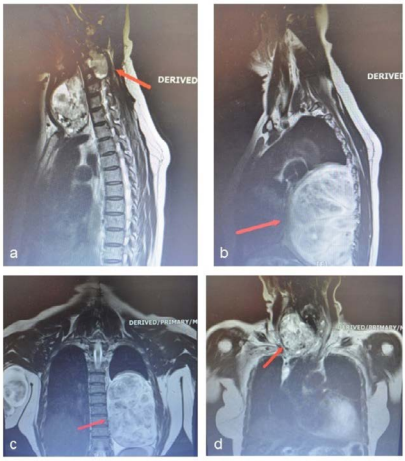

Fig. 2. Magnetic resonance imaging (MRI) of the spine. (*a*) Lobulated right extradural lesion at the right neural foramen with adjacent significant cord compression and narrowing of the spinal canal. (*b*) Anteroposterior and (*c*) lateral view of a large heterogenous lesion at the left thoracic paravertebral region. (*d*) Large right thyroid lesion with retrosternal extension and significant mass effect, shifting trachea to the left with significant luminal narrowing of 4 mm at level of C6 and compressing left bronchus

patient was mechanically ventilated overnight in the intensive care unit postoperatively. After a positive cuff leak test, the patient was extubated with no respiratory compromise. She was discharged well 3 days after the operation.

Discussion

The coexistence of cervical spine tumours with anterior and posterior mediastinal tumours is rare. This is the first case report involving these four tumours simultaneously to date. The first lesion involved two cervical neurofibromas with myelopathy that demanded minimal neck movement during airway management to prevent secondary spinal cord injury. The second tumour was a large, left, posterior mediastinal tumour that has been suggested to carry a low risk of anaesthetic complications. However, a case of large posterior mediastinal mass that required urgent transition to extracorporeal membrane oxygenation (ECMO) has been reported due to haemodynamic and respiratory decompensation upon induction of general anaesthesia.[3] The last and most significant tumour was a large retrosternal goitre in the anterior mediastinum with airway compression that led to CAO and mandated spontaneous ventilation. This was to preserve the diaphragm in caudal position, thereby maintaining normal pleural pressure, keeping the airway dilated, and minimizing airway collapsibility due to airway compression by the mediastinal mass.[4] In severe cases of CAO, ECMO has been used when there are doubts in maintaining oxygenation with either an endotracheal tube or a rigid bronchoscopy.[5]

Establishing an airway is challenging in patients with severe CAO as it may be distal and precludes the option of front of neck access.[5] The decision for pre-emptive standby of ECMO as a salvage therapy can be difficult. Hence, it is useful to assign the patient a severity grade of safe, uncertain, or unsafe based on the classification of anaesthetic risks for mediastinal mass syndrome.[6] Mediastinal mass syndrome denotes the clinical picture caused by a mediastinal mass in anaesthetized patients. It can occur at every stage of anaesthesia and spiral down into acute respiratory or hemodynamic compromise, or both.[6] Management of adult patients is guided by the severity of symptoms and computerized tomography (CT) scan. Patients are deemed safe if they are asymptomatic and the CT scan shows tracheal/bronchial diameter > 50% of normal. Patients are deemed unsafe if severely symptomatic and the CT scan shows tracheal/bronchial diameter < 50% of normal. Patients are deemed uncertain if they are mildly or moderately symptomatic or asymptomatic, but the CT scan shows tracheal/bronchial diameter < 50% of normal. Grading of symptoms is further classified into mild, moderate, or severe. Patients graded as mild can lie supine with some cough/pressure sensation; those graded as moderate grade can lie supine for short periods but not indefinitely; and those graded as severe grade cannot tolerate a supine position.[7]

Our patient fell into the uncertain group as she was asymptomatic despite imaging showing compression of the tracheal diameter < 50% of normal by goitre. The recommended anaesthetic management for this risk group involves awake fibreoptic intubation, as it preserves spontaneous ventilation; determination of optimal positioning of patient during preinduction, as it will be the position that causes least compression; rigid bronchoscopy as rescue therapy; and monitoring for airway compromise postoperatively.[7] Due to a lack of evidence from a similar case, the authors had planned the anaesthetic management based on this classification. Although the severity grading is intended to guide airway management for mediastinal mass, it has proven useful in managing multiple tumours affecting the airway, as happened in our case, which was treated in a centre devoid of ECMO.

In cases of critical airway obstruction, there is little evidence to suggest remifentanil is superior to dexmedetomidine as the sole sedative agent for awake fibreoptic intubation.[8] The option is based on individual experience and judgement on a case-by-case basis. Remifentanil was chosen in our case as it has little effect on cognition, suppresses the airway reflex, and is easily titratable due to its unique pharmacokinetic characteristics.

Conclusion

Awake nasal fibreoptic intubation under monitored anaesthesia using a titrating dose of TCI remifentanil 1–3 ng/mL and airway topicalization with local anaesthesia is the preferred mode of airway management for multicompartmental tumours. The classification of anaesthetic risks for mediastinal mass syndrome was useful in planning airway strategies for such a perplexing enigma.

Declarations

Informed consent for publication
The patient provided informed consent for the publication of the clinical data and images contained in this case report.

Competing interests
None to declare.

Funding
None to declare.

Acknowledgements
None to declare.

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© Malaysian Journal of Anaesthesiology 2022; 1:45-51
Case series/Case report
https://doi.org/10.35119/myja.v1i1.11

Anaesthetic management of labour and caesarean delivery for a morbidly obese parturient with subglottic stenosis

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Abstract

A 31-year-old parturient with body mass index of 52 kg/m^2 and subglottic stenosis, complicated with obstructive sleep apnoea and history of cardiac failure presented in labour. With prior multidisciplinary antenatal and anaesthetic assessment and counselling already in place, epidural was started in early labour via combined spinal-epidural (CSE) technique. The epidural was efficacious in providing labour analgesia and later successfully used for extension of anaesthesia for emergency caesarean delivery for failure to progress. Effective postoperative analgesia via multimodal non-opioid strategy enabled early mobilization and breathing exercises to prevent potential complications during the postpartum period. We present a case to highlight the versatility of the CSE technique in providing effective analgesia in various clinical situations, especially in patients with potential disastrous airway. Early multidisciplinary antenatal assessment and planning by obstetric, otorhinolaryngologic, cardiology, and anaesthetic teams facilitated optimal management of this complicated case.

Keywords: caesarean section, combined spinal epidural, labour analgesia, morbid obesity, subglottic stenosis

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Introduction

Managing a morbidly obese parturient with multiple comorbidities and airway anomalies is highly challenging. Although rare, the presence of subglottic stenosis may lead to a potentially disastrous airway crisis. Early involvement of multidisciplinary teams is important in managing complex cases such as this. Placing a functional epidural catheter for labour analgesia is advantageous, as it provides effective analgesia and can be utilized should any operative intervention required. We present a successful management of labour and caesarean delivery in a case of a morbidly obese parturient with difficult airway compounded with subglottic stenosis.

Case presentation

A 31-year-old gravida 2 para 1 woman with body mass index of 52 kg/m^2 (119 kg, 153 cm) presented to the labour ward at 38 weeks' gestation. She weighed 70 kg during her previous pregnancy and underwent an uncomplicated emergency caesarean section under spinal anaesthesia for foetal distress in 2015. In 2019, she was intubated for decompensated cardiac failure that was complicated with subglottic stenosis of Cotton-Myer Class II (50% stenosis). Her sleep study showed apnoea–hypopnoea index of 90.5. Otorhinolaryngologic (ORL) assessment revealed Friedman III, tonsillar enlargement grade 3 bilaterally, and adenoid enlargement with 80% covering the posterior choanae. She also had bronchial asthma, chronic hypertension, and gestational diabetes mellitus. Her latest echocardiography showed ejection fraction of 55%, dilated left ventricle, pulmonary artery systolic pressure of 18 mmHg, and normal regional wall motion. She tolerated this pregnancy well, without significant reduction in effort tolerance or hospitalization.

Normal vaginal delivery was planned after early assessments by multidisciplinary teams. She was counselled for early epidural during high-risk anaesthesia clinic review. In addition to the advantages of labour epidural, the possibility of technical difficulties during insertion of epidural, morbidities associated with intubation, and general anaesthesia were discussed.

During the first stage labour, when cervical os was 4 cm, a single attempt CSE was inserted. A standard 9-cm Tuohy needle was used with loss of resistance to saline technique. It was inserted at L3-L4 level using landmark technique with the patient in seated position. The skin-to-epidural-space distance was 7 cm and the catheter was secured at the 12-cm mark with 5 cm resting in the epidural space. The spinal dose was 0.5 ml of heavy bupivacaine 0.5% with fentanyl 10 mcg. Her labour analgesia was effectively maintained with patient-controlled epidural

analgesia (PCEA). The PCEA regime used 0.05% ropivacaine with fentanyl 2 µg/ml with settings as follows: bolus 10 ml, lockout interval 10 minutes, and basal infusion of 10 ml/hour. Her pain score was 1–3 assessed using the visual analogue scale.

Her labour failed to progress, and she was planned for emergency caesarean delivery. The ORL team was alerted due to the possibility of needing rescue front of neck access (FONA) should the scenario of "cannot intubate, cannot ventilate" ensue. PCEA was maintained for a duration of 10 hours until her arrival to the operating room.

An invasive blood pressure monitoring was inserted prior to epidural extension for surgical anaesthesia. Her epidural anchorage was rechecked before topping up with lignocaine 2% and adrenaline 1:200,000, given in 3-ml aliquots, with a total of 6 ml over 10 minutes to achieve sensory block up to T5 dermatome level. She required two top-ups, each 3 ml, approximately at 15 and 45 minutes after the start of the surgery. Intravenous phenylephrine infusion was initiated concurrently as prophylaxis against hypotension associated with neuraxial anaesthesia, at a dose of 250–500 µg/H. Her blood pressure was maintained around 100–130/55–75 mmHg. Nasal prong oxygen 3L/min was given as her oxygen saturation was 93–96% under room air in a supine position. The surgery was uneventful with delivery of a healthy baby girl of 2.82 kg with APGAR scores of 9 and 10.

Ten ml 0.2% ropivacaine was given via epidural catheter in the recovery unit prior to catheter removal. Removal of the catheter allowed timely commencement of subcutaneous enoxaparin for deep venous thromboprophylaxis. Her analgesia was maintained with oral paracetamol 1 g 6-hourly and mefenamic acid 500 mg 8-hourly. Patient-controlled-analgesia (PCA) or neuraxial opioid was avoided. Acute pain service assessment revealed a satisfactory pain score of 0–2. She ambulated and did breathing exercises on day 1 post-delivery. She was monitored in the maternal high-dependency unit and discharged well on day 5 post-delivery.

Discussion

Maternal obesity is a growing maternal health concern globally, affecting maternal care in various aspects. According to Malaysia's 2016 National Health Morbidity Survey, the prevalence of maternal obesity increased to 14.6%,[1] further straining the country's healthcare burden.

Super obesity (BMI ≥ 50 kg/m^2) and its comorbidities place the parturient and foetus at increased risk of complications related to pregnancy, surgery, and

anaesthesia with failed intubation and aspiration representing approximately two-thirds of the cause of deaths.[2] The incidence of difficult intubation was as high as 33% among parturients above 136 kg.[3] The risk was particularly high in this patient, who had subglottic stenosis Cotton-Myer II on top of the difficult airway anticipated in a super-obese parturient.

Early placement of a functional epidural catheter in labour can reduce the risk of complications related to general anaesthesia. The epidural catheter can be used to establish a desired level of anaesthesia in a short period of time in case of emergency caesarean delivery. The CSE technique provides a rapid onset dense spinal anaesthetic with the flexibility of an epidural extension and titration. Furthermore, the failure rate of epidural catheter inserted using the CSE technique is lower than using epidural-only technique.[4] The appearance of cerebrospinal fluid in the spinal needle indirectly confirms midline epidural space placement of the epidural needle, increasing the likelihood of a functional catheter.[4]

With the epidural catheter in place, surgical anaesthetic levels can be achieved within minutes in an emergency situation with stepwise incremental local anaesthetic (LA). Morbid obesity may result in an unpredictable, exaggerated spread of LA and significantly decreased epidural LA requirements, and increase the risk of a high neuraxial block,[3] which may necessitate emergent intubation. Additionally, super-obese parturients have approximately 20–40% longer surgical, anaesthesia, and total theatre times.[5] Epidural anaesthesia could overcome these problems by allowing flexible titration of level, density, and duration of anaesthesia.

Epidural placement might be technically difficult. The thick subcutaneous adipose tissue can make palpation of landmarks difficult.[6] Ultrasonography can be used to identify and estimate the depth of epidural space and midline. Morbidly obese parturients have a higher incidence of initial epidural failure rate of 42%, *versus* 6% in the general population.[6] Epidural catheter migration is more likely due to the sliding of skin over subcutaneous tissue. It is important to regularly reassess the analgesia provided by the epidural catheter. A poorly functioning labour epidural catheter requiring frequent top-up doses may fail to provide adequate surgical anaesthesia[7] and should be replaced early.

When general anaesthesia is unavoidable, the safest course of action is a planned awake fibre optic intubation, which along with topical anaesthesia may allow the patient to maintain oxygenation with spontaneous ventilation. The nasal mucosa in parturients is engorged despite topical anaesthesia and vasoconstriction, and may precipitate bleeding, leading to failed fibre optic intubation and compromised airway. Therefore, the oral route is preferred. However, the disadvantages include stimulation of the gag reflex, requiring denser airway anaesthesia and poorer

patient tolerance, as well as the risk of dental trauma.[8] It is also important to anticipate sudden loss of airway in the event of a high or total spinal block. The ORL team had been alerted beforehand in anticipation of a potential airway crisis.

The sedative effect of opioids could exacerbate the patient's condition of severe obstructive sleep apnoea. Routine neuraxial morphine was avoided due to the concern of not being able to safely secure the airway outside of the operating room setting should any airway loss occur postoperatively. Consequently, epidural ropivacaine was given, precluding the need for PCA opioid.

A multimodal analgesia strategy with neuraxial block in combination with non-opioids facilitates potentially early hospital discharge with minimal side effects on the mother and infant[9]. Early mobilization, compression stockings, and low molecular weight heparin should be used to prevent thromboembolic disease in these patients who are particularly at a higher risk.

Above all, the role of early assessment and advanced planning in managing a complicated super-obese parturient with airway anomaly is crucial. Multi-disciplinary consultation allows assessment of the risk and benefits of various management plans. Additionally, maternal decisional conflict scores were shown to be significantly lower with antenatal anaesthetic consultation.[10] In our case, a comprehensive early assessment and work-up by a multidisciplinary team offered essential insights for planning and thus contributed to the successful management of this case.

Conclusion

This report presents a successful case of anaesthetic management in a super-obese parturient with subglottic stenosis and multiple comorbidities. She was at high risk for both general and regional anaesthesia. Due to anticipated difficult airway, an airway strategy should be devised with the involvement of expert team for possible FONA. An early labour epidural using CSE technique provided effective labour analgesia. CSE is a reliable technique for indirectly confirming the correct positioning of the epidural needle with higher initial success rates, reducing the need for catheter re-siting, and ensuring successful extension for surgery. This avoids the need for hazardous intubation and airway catastrophe.

Declarations

Informed consent for publication
Informed consent form has been signed by the patient and available if requested by MyJA

Competing interests
None to declare.

Funding
None to declare.

Acknowledgements
This case report was presented virtually during KoreAnesthesia 2021, held November 4–6 2022.

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© Malaysian Journal of Anaesthesiology 2022; 1:52-59
Case series/Case report
https://doi.org/10.35119/myja.v1i1.10

Chylothorax and mediastinal haematoma by central venous catheter post-duodenal ulcer and pyloroplasty surgery: a case report

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Abstract

In handling critically ill patients, central venous catheterization is a fundamental procedure. Incidence of pleural effusion and mediastinal haematoma following central venous placement is rare, with a rate between 0.17% and 1%. We report a frail elderly man who was started on parenteral nutrition administered by left internal jugular vein catheter post-emergency laparotomy surgery for a perforated duodenal ulcer. He developed bilateral chylothorax immediately on the first day of parenteral nutrition supplement. Contrast-enhanced computed tomography of the thorax as part of chylothorax workouts incidentally revealed anterior mediastinal haematoma in communication with the catheter tip, implying likely an iatrogenic injury. Rapid onset of chylothorax may indicate a thoracic duct injury and concurrent parenteral nutrition content leakage from the extravasated catheter. The anatomical connection between the pleural and mediastinal cavities has not been clearly illustrated in the literature. Bilateral chest drains were inserted and the catheter was removed at bedside without complications. Despite using ultrasound guidance, clinical methods and post-procedure chest X-ray, the catheter malposition was not detected before initiation of parenteral nutrition. The learning point is for the clinician to remain vigilant for potential catheter-related complications.

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Keywords: anterior mediastinal haematoma, central venous catheter, chylothorax, iatrogenic injury, parenteral nutrition

Introduction

Since the introduction of the central venous catheter (CVC) on the battlefield in 1952, CVC has become an essential route of venous access in clinical practice, especially in critically ill patients for fluids, medications, and parenteral nutrition (PN) as well as for hemodynamic monitoring.

The CVC insertion site selection is determined by clinical indications and practitioner expertise. The upper body site is favoured over the femoral site due to the lower infection risk. Insertion is invasive and associated with complications, which are categorized as related to catheter insertion, indwelling, and extraction.[1] Catheter-related complications include carotid artery punctuate, pneumothorax, through and through cannulation, tracheal injury, air embolism, catheter malposition, bloodstream infection, and thrombosis. Chylothorax is a rare complication.[2] Mediastinal haematoma is also uncommon.[3] It can be fatal if the haematoma expands. Even rarer is the occurrence of concurrent chylothorax and mediastinal haematoma.

Local precaution checklists are recommended, which include strict aseptic technique, presence of an assistant, ultrasound guidance, clamping the guidewire during catheter advancement, and shouting when the guidewire is removed. Ultrasound has reduced the incidence of immediate complications from 11.8 % to 4–7%.[4] CVC is commonly inserted in emergency surgery for intraoperative and postoperative use. Post-laparotomy bowel surgery patients often need prolonged vascular access for PN.

Case presentation

A 68-year-old retired Malay elderly with long-standing type 2 diabetes mellitus and hypertension was initially admitted under surgical team for urosepsis secondary to the right emphysematous pyelonephritis with right perinephric and pararenal collections. He was completely dependent in daily activities due to a recent stroke. He had Forrest IIc gastric ulcer. After 10 days course of intravenous (IV) piperacillin-tazobactam targeted for *Enterobacter cloacae* yield from the pelvic collections, he was discharged home with percutaneous drains at both flanks.

He was readmitted the next day with hypovolemic shock from melaena and anaemia-induced angina. A haemoglobin drop of 6 g/dL was reported. Despite adequate fluid resuscitation, he required IV noradrenaline infusion. He was given IV esomeprazole infusion and kept fasted for oesophageal-gastro-duodenoscopy (OGDS). His bleeding Forrest Ib ulcer ulcer at the first part of the duodenum was secured. Recurrent hypovolemic shock with massive melaena prompted a second OGDS within 24 hours. OGDS revealed an oozing spot at the previous ulcer site and bleeding was secured. Eight pints packed cell and one cycle of disseminated intravascular coagulation regime were transfused. However, due to persistent melaena an emergency pylorotomy, underrunning of duodenal ulcer, and pyloroplasty surgery were performed under general anaesthesia with intraoperative findings of Forrest Ia ulcer at part one and two of the duodenal junction.

A left internal jugular vein (IJV) CVC with 7 French quadruplet lumens was inserted preintubation under ultrasound guidance in a single attempt without immediate complications. The patient's coagulation profile and platelet count were within the normal range. No antiplatelet or anticoagulant medications were used on the patient. A left IJV was chosen as he had a 16G branula inserted in the right neck for inotrope use. The catheter was used for inotrope administration and electrolyte correction during surgery. Postoperatively, the patient was weaned in the intensive care unit. A post-procedure chest X-ray showed the CVC tip at the left innominate vein with no adjustment done. Starting the second postoperative day, the catheter was used to administer PN.

On the same day, computerized tomography (CT) of the abdomen and pelvis performed to assess the pelvic collections revealed bilateral moderate pleural effusion as an incidental finding. CT angiography of the abdomen conducted after 48 hours to identify any active intra-abdominal bleeding showed persistent pleural effusion. The patient was not ready for enteral nutrition; as such, PN was continuously delivered via the catheter. As he developed acute on chronic kidney disease with hyperuriceamia, a right IJV double-lumen was inserted later for intermittent haemodialysis.

His condition improved, but he failed a spontaneous breathing trial (SBT) and had persistent leucocytosis. The bilateral pleural effusion could have contributed to the failure of SBT (Fig. 1). A right chest drain was inserted for diagnostic and therapeutic purposes. The pleural fluid had biochemical characteristics consistent with aseptic and uncomplicated chylothorax (Table 1). Hence, the catheter was discontinued. A right femoral CVC was inserted for the continuation of PN.

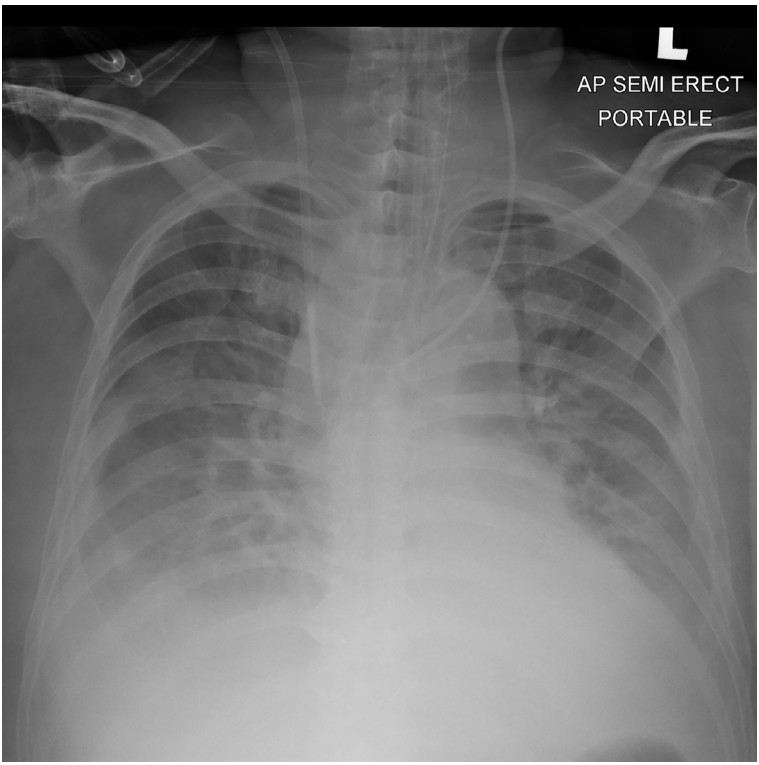

Fig. 1. AP chest X-ray taken in semierect position on day 4 post-left internal jugular vein (IJV) central venous catheter (CVC) insertion and immediately post-right IJV double lumen catheter insertion. Greater bilateral pleural effusion is seen on the right side than in the left side. The left CVC tip was at the left innominate vein. The right double lumen tip was in the lower third of the superior vena cava.

The case was referred to the respiratory team for the likely traumatic chylothorax post left IJV CVC insertion. CT of the thorax revealed a large anterior mediastinal haematoma communicating with the left IJV CVC tip (Fig. 2, left). Bilateral pleural effusion was also noted (Fig. 2, right). Right thoracoscopy was performed under general anaesthesia to rule out pleural pathology. Pleural biopsy found no malignant cells. Intraoperative findings were minimal anthracosis and whitish pleural thickening. In our centre, lymphangiography was not avaialble to rule out thoracic duct injury or leak.

Table 1. Bilateral pleural fluid results

Parameters	Right pleural fluid (3/12/21)	Serum	Left pleural fluid (10/12/21)	Serum
Cholesterol (mmol/L)	< 0.5	2.8	0.56	1.6
Triglycerides (mmol/L)	14 (> 1.1 mmol/L)	N/A	13.3 (> 1.1 mmol/L)	1
pH	8 (Uncomplicated)		8 (Uncomplicated)	
Appearance	Milky		Milky	
Glucose (mmol/L)	10.9	8.8 (PSR 1.2)	4.4	6.3 (PSR 0.7)
Protein (g/L)	<30	39 (PSR N/A)	< 30	48 (PSR N/A)
LDH (U/L)	400	386 (PSR 1.0)	754	309 (PSR 2.4)
Microbiology test	Negative	N/A	Negative	N/A

LDH: PSR: pleural to serum ratio; N/A: not applicable

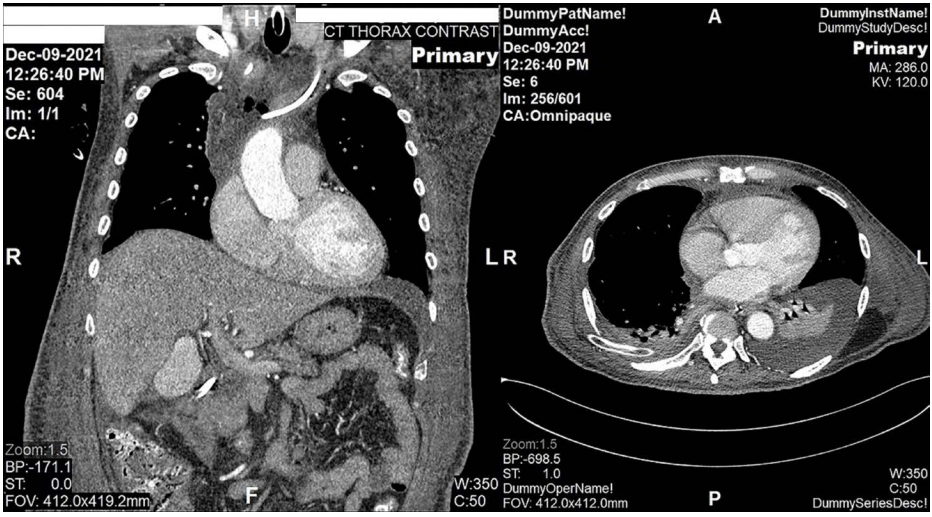

Fig. 2. (*Left*) Computed tomography (CT) of the thorax (coronal view) showing anterior mediastinal haematoma with intervening air pockets. This collection measured approximately 3.9 x 8.7 x 13.1 cm (AP x W x CC) . The distal tip of the left internal jugular catheter is seen to be extravascular and within the mediastinal haematoma. (*Right*) CT of the thorax (axial view) showing bilateral pleural effusion (moderate on the left and minimal on the right), with adjacent collapsed consolidation of the whole lower left lobe.

A left chest drain was inserted to reduce mediastinal collection size. The pleural fluid features on the left were consistent with those of the right. The vascular team was referred. They decided to remove the extravasated CVC at bedside, with an interventional radiologist and a cardiothoracic surgeon on standby in anticipation of an expanding mediastinal haematoma due to the loss of compression haemostasis of the catheter. It was performed without immediate complications.

The patient was extubated and transferred to ward the next day. In the ward, enteral feeding was established. The femoral CVC was kept for the administration of medications. Unfortunately, the patient died after 2 weeks of type 2 myocardial infarction from nosocomial infection.

Discussion

The incidence of catheter-related complications is higher in left-sided IJV catheterization due to anatomical differences.[5] These include catheter malposition and thoracic duct injury. The ideal CVC tip position is in the lower third of the superior vena cava or near the cavoatrial junction.[6] The right IJV course is direct into the right innominate vein compared to the left IJV, which runs through a longer course before draining into the superior vena cava. The left-sided catheter has a higher chance of abutting the vessel wall and is more likely to cause vascular injury due to friction. Other risk factors are anatomical variations, patient positioning, and the angle formed between the CVC tip and vessel wall. Our centre has published a case of inadvertent puncture of the right vertebral artery during right IJV CVC insertion due to the vessel's anatomical variation.[7] The catheter was removed under contrast study guidance by an interventional radiologist.

A case of bilateral pleural effusion and pneumomediastinum resulting from left subclavian vein puncture during peripherally inserted CVC line placement has been reported.[8] The patient presented with hypoxaemic respiratory failure. Pulmonary CT angiogram was performed to look for pulmonary embolism, revealing the vascular injury. A sternotomy, CVC removal, and primary repair of the subclavian vein were performed.

In our case, iatrogenic pleural effusions and mediastinal haematoma were diagnosed early from CT imaging, hence the prompt chest drains insertions and referrals to the respiratory, vascular, and interventional radiology teams. The removal of the extravasated CVC was performed without immediate complications. Rapid onset of chylothorax indicates acute leak or injury to the thoracic duct, particularly the left subclavian trunk, which drains into the left subclavian vein and left innominate vein junction. This was further suggested by a large mediastinal

haematoma evidenced on CT scan, which could have occurred during the initial puncture or catheter placement using Seldinger's technique. Catheter migration, however, could not be ruled out. Lymphangiography and lymphoscintigraphy are useful in identifying major lymphatic leaks.[9] Yet, a few cases reported in this study revealed no significant contrast leak and the location of the leakage could not be pinpointed. Another possible explanation for chylothorax is accumulation of PN into the pleural cavities through the extravasated CVC tip.

The anatomical connection between the pleural and mediastinal cavities has not been clearly illustrated in the literature. CT scan showed the anterior mediastinal haematoma was likely in communicating with the pleural cavities through the malpositioned CVC. In case of inadvertent catheter cannulation-related mediastinal haematoma, the catheter should not be removed until the injury site is visualized under surgical exploration or angiographic monitoring and immediate intervention is available.

Ultrasound guidance may not prevent catheter malpopasition, vessel injury during guidewire insertion, and dilatation of the punctured vessel. A blunted costophrenic angle can detect pleural effusion. A chest X-ray showing evolving widened mediastinum should give a hint on iatrogenic vascular injury.

Conclusion

CVC insertion under ultrasound guidance reduces complications but does eliminate the risk. Iatrogenic thoracic duct injury and catheter malposition should be considered, particularly when a left-sided neck vein is catheterized. PN administration through a misplaced catheter may be associated with chylothorax. A mediastinal haematoma could have occurred during the initial vessel puncture or catheter placement. This case highlights the significance of a high index of suspicion and timely multidisciplinary intervention in cases of rare and catastrophic complications to reduce adverse outcomes. Despite following the recommended precautions, the clinician must confirm catheter position post-insertion and continuously monitor its function. In our case, rapid chest drain insertion was followed by removal of the left IJV catheter.

Declarations

Informed consent for publication

The patient provided informed consent for to the publication of the clinical data and images contained in this case report.

Competing interests
None to declare.

Funding
None to declare.

Acknowledgements
The authors wish to acknowledge the staff in the Department of Anaesthesiology and Intensive Care at Sultan Ahmad Shah Medical Center for the continuous support in this case report.

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© Malaysian Journal of Anaesthesiology 2022; 1:60-65
Case series/Case report
https://doi.org/10.35119/myja.v1i1.3

Atypical presentation of renal cell carcinoma: a case report

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Abstract

Our patient was a 61-year-old male who first presented with a diagnosis of renal cell carcinoma and low oxygen saturation at rest. An urgent computed tomography of the thorax revealed a filling defect in the distal left pulmonary artery. We describe our perioperative management of this patient and highlight some challenges in his postoperative care.

Keywords: renal cell carcinoma, tumour thrombus

Introduction

Patients with renal carcinoma require extensive pre-, peri-, and postoperative management. An approach to the anaesthetic technique will involve discussions with the surgical teams involved so that potential challenges to conduct anaesthesia in this high-risk patient group can be anticipated and tackled appropriately. We

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present a case in which there was a presentation of both abdominal pain and low oxygen saturation, a rare presentation at the time of diagnosis. The surgical team involved comprised of one urologist, one vascular surgeon, one hepatobiliary surgeon, and two cardiothoracic surgeons. Postoperatively, the haematologist, oncologist, and nuclear medicine physicians were instrumental in co-managing the patient together with the surgical teams as well as the anaesthesiologists.

Case presentation

A 61-year-old Indian male presented with sudden onset left-sided loin pain of 1-day duration. He reported no history of haematuria, fever, chest pain, or shortness of breath and there was no history of kidney stone disease. He had a past medical history of hypertension on telmisartan/amlodipine and well controlled diabetes mellitus on metformin/vildagliptin.

On examination, the abdomen was non-tender. The haemodynamic vital signs were stable; however, his baseline O2 saturation was 88% on room air. An urgent computed tomography (CT) scan of the thorax and abdomen was performed revealing a left renal tumour with renal vein/inferior vena cava (IVC) thrombus. There was also a filling defect suggesting possible thrombus in the left pulmonary artery (PA).

He was admitted to the High Dependency Unit (HDU) for observation and supplemental nasal prong O2 2 L/min. In HDU, he was in sinus rhythm with a pulse rate of 85–95/min with oxygen saturation of 95% on O2 2 L/min. The respiratory rate was 15–20/min. The patient was also started on subcutaneous enoxaparin 60 mg daily preoperatively instead of a higher therapeutic dose as he already had thrombocytopaenia and was also planned for emergency surgery; as such, the need to balance the risk of bleeding perioperatively. Haematological and coagulation parameters were all normal aside from a mild thrombocytopaenia with platelet count of 128.

Our clinical impression was a pulmonary embolism secondary to a venous or tumour thrombus in the main distal left PA and possibly right atrium from the left renal cell carcinoma. An electrocardiogram-gated CT of the PA was performed next to precisely delineate the location and extent of the thrombus/tumour. The CT (Fig. 1) confirmed a large tumour/thrombus obstructing the distal main left PA and IVC thrombus that extended proximally, just distal to the hepatic vein. There was no evidence of clot in the right atrium or right ventricle.

The decision to proceed with surgery was finalised and informed consent obtained. We divided the procedures into three stages, namely, laparotomy with

radical left nephrectomy by the urologist, infra-diaphragmatic IVC thrombectomy by the hepatobiliary and vascular surgeons, and finally concluded with sternotomy and pulmonary thromboembolectomy on cardiopulmonary bypass (CPB) with systemic heparinisation by the cardiothoracic team. As the patient was relatively stable at this point from an oxygenation point of view, it was decided that the laparotomy would start first so that any bleeding issues resulting from the nephrectomy and the IVC thrombectomy could be tackled first so that the effects of heparinization that would occur during CPB later could be minimised. If problems in oxygenation were encountered during the laparotomy, the cardiothoracic team were on standby for immediate cannulation and commencement of CPB.

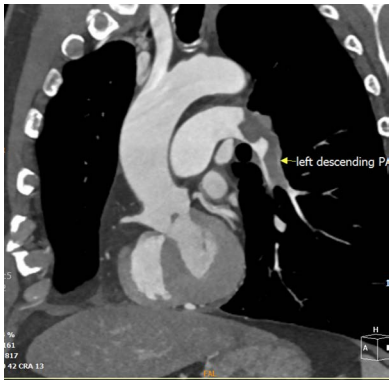

Fig. 1. Computed tomography of the thorax (coronal view) showing filling defects at the distal left main pulmonary artery.

Among the issues anticipated were significant blood loss, reduced venous return due to IVC clamping that may require volume loading and inotrope support, need for systemic anticoagulation with heparin during CPB, postoperative coagulopathy, and acute ischaemia-reperfusion lung injury in addition to difficulties in weaning from CPB.

On the operative day, the patient was put on standard electrocardiogram (ECG), blood pressure, and pulse oximetry monitoring. A 16G intravenous peripheral cannula and a 20G right radial arterial cannula were inserted under local anaesthesia. He was induced with intravenous (IV) palonosetron 75 µg, fentanyl 100 µg, IV propofol 100 mg, and IV rocuronium 60 mg, and intubated smoothly. Another 16G peripheral IV cannula and a right internal jugular vein triple lumen catheter were inserted uneventfully. A transoesophageal (TOE) probe was then inserted. Intraoperative TOE by our cardiologist revealed a normal-sized right atrium and ventricle with an intact atrial septum and no intracardiac clot. The volume status of the patient was assessed using both central venous pressure monitoring and TOE.

The urology team performed the laparotomy first via a midline and transverse incision. The kidney was mobilised and radical nephrectomy was performed. Subsequently, the hepatobiliary and vascular surgeons approached the IVC and were able to remove the tumour thrombus with relative ease. Clamping time was approximately 30 minutes. The teams were very careful in removing the tumour thrombus during the surgical manipulation and, where necessary, vascular clamps

Fig. 2. Tumour thrombus in the left main pulmonary artery removed en bloc.

and suture ties were used to minimise the risk of embolisation. Upon resection of the left renal cell tumour and concomitant IVC tumour thrombectomy, the cardiothoracic team took over.

The chest was accessed via a median sternotomy and CPB was instituted with routine cannulation (aortic 20F and 2-stage venous 32F) once adequate systemic heparinisation was achieved (activated clotting time > 450 sec) and normothermia maintained at 36°C. Given the absence of intracardiac clot, the heart was not arrested, and the pulmonary tumour embolus was approached via a 4-cm longitudinal incision in the distal main PA extended in a curvilinear fashion into the left PA. A large, organised tumour thrombus (Fig. 2) was removed en bloc under direct vision with a pair of gallstone forceps and good back bleeding was achieved. A 6F balloon embolectomy catheter was then carefully passed down distally several times, but no further clot was retrieved. The PA was lavaged with heparinised saline and closed primarily with a running 5-0 prolene monofilament non-absorbable suture. The patient was weaned from CPB with ease, decannulated, and the chest wired closed after insertion of mediastinal chest drains.

Four pints of whole blood and four units of platelets were transfused to achieve satisfactory haemostasis. A disseminated intravascular coagulation (DIVC) screen was ordered and an additional DIVC regime of six cryoprecipitate, four units of fresh frozen plasma, and two units of platelets was given. Postoperatively, he was sent to the Intensive Care Unit (ICU) and kept ventilated overnight.

There were two main issues that were of concern postoperatively, mainly of the respiratory and haematology systems. The patient was slowly weaned off the ventilator on postoperative day 1 and extubated on day 2. The chest X-ray and the first few arterial blood gases after extubation showed hypoxemia suggestive of acute lung injury (ALI) as per the American-European Consensus Conference definition. This was potentially attributed to either transfusion-related or post-CPB changes. He was put on non-invasive ventilation therapy to support his oxygenation, and this was weaned off after 3 days to room air. He also received nebulised bronchodilator therapy and routine chest physiotherapy.

There was evidence of coagulopathy post-surgery with some bleeding noted from the drains. There was preoperative thrombocytopenia, raised prothrombin

time, normal partial thromboplastin time, and fibrinogen. The bleeding settled after correction of all haematological indices, and he was put on anticoagulation; initially subcutaneous enoxaparin (therapeutic dose) until discharge and thereafter on oral rivaroxaban for 3 months.

The pathologist reported that the morphology of the tumour cells in the pulmonary embolus were similar to those of the main tumour, thus favouring metastases and not direct thrombus extension (from the IVC), as there was no clot or tumour from the right atrium or ventricle.

Discussion

Renal cell carcinoma has a tendency to invade vascular structures, extending into the IVC as well as the right-sided chambers of the heart. In some patients, the need to perform surgery on CPB and deep hypothermic circulatory arrest may be necessary.

Shriner *et al.* have stated that microscopic pulmonary tumour embolism is difficult to diagnose; often, the initial clinical symptom is subacute progressive dyspnoea, and the initial laboratory evaluation typically shows hypoxemia in a patient with clear lung fields on a chest X-ray. They also noted that pulmonary angiography may not disclose evidence of emboli. As such, clinicians should maintain a high degree of clinical suspicion when encountering a patient with a renal tumour presenting with shortness of breath or lower than expected oxygen saturation. This clinical suspicion must be followed through with the relevant radiological imaging to ensure that the exact structural lesions and their spread is determined preoperatively. In our patient, an ECG-gated CT angiogram was helpful to precisely delineate the extent of the tumour and intrathoracic involvement. Often, this technique is requisite to obtain accurate high-quality scans void of pulsation artefact.

Intraoperative TOE is important to delineate the cardiac and pulmonary arterial structures and extent of tumour vascular invasion. The absence of clot or tumour in the right heart (on TOE) allowed us to perform the surgery without inducing cardioplegic arrest. The pulmonary thromboembolectomy was done safely on a beating heart with CPB support. The latter, effectively “rests” the heart sufficiently and provided adequate visualisation to facilitate the thrombo-embolectomy.

Any CPB-induced ALI may be further exacerbated by possible lung reperfusion injury following the pulmonary thromboembolectomy. Studies have shown that the incidences of ALI vary from 0.4% to 20%. ALI remains an important postoperative complication that needs to be recognised early. The patient remained stable during the surgery as well as in the ICU and only required a short period of mechanical

ventilation before being weaned to a non-invasive mode of ventilation (high-flow nasal cannula). He was monitored with constant meticulous appraisal of his breathing effort and ventilatory parameters (ABG, CXR, oxygen requirements, etc).

Conclusion

Successful outcome of a complex case is best achieved with multidisciplinary planning. Once issues have been identified in the preoperative period, complications can be anticipated and tackled appropriately.

Declarations

Informed consent for publication
The patient provided signed informed consent for the publication of the clinical data and images contained in this case report.

Competing interests
None to declare.

Funding
None to declare.

Acknowledgements
None to declare.

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Anaesthe-quiz
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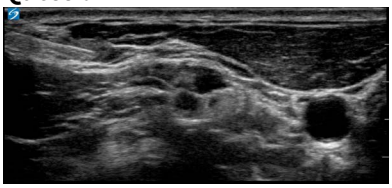
Regional anaesthesia

Multiple true or false questions

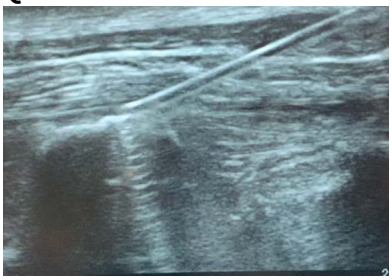
Question 1



The sonoanatomy image above shows a particular regional anaesthesia technique. The technique is essential for anaesthesia and/or analgesia for surgeries involving the:

a. forearm
b. shoulder joint
c. clavicle
d. carotid
e. thyroid

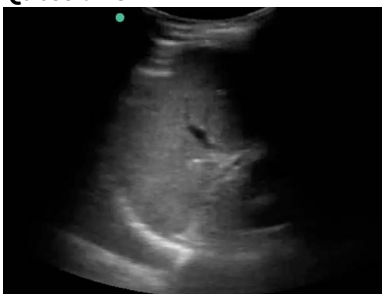
Question 2



The sonoanatomy image above shows a particular regional anaesthesia technique that has been proven effective for analgesia for the following surgeries:

a. thoracotomy
b. open heart surgery
c. laparoscopic cholecystectomy
d. open inguinal hernial repair
e. lumbar spine surgery

Question 3



The point-of-care ultrasound image shown above is important in the diagnosis of a complication involving regional blocks. The complication is likely to happen in:

a. interscalene block
b. superficial cervical plexus block
c. costoclavicular block
d. supraclavicular block
e. axillary block

Short Answer Question

Question 4

List the methods to improve block needle visibility during the performance of ultrasound-guided regional anaesthesia.

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2. The quiz contains three multiple true or false (MTF) questions and one short answer question. Each MTF has five answers identified as a, b, c, d, e, which are either 'true' or 'false'.
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MY-ATR-06-22-00001

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