patients with a low IVC-CI had received a similar fluid volume to those with a high IVC-CI?

There are also a number of errors in the study design and reporting:

(i) The authors administered the 'appropriate vasoactive drug' only after '5 min of persistent hypotension'. This contradicts the standard management for post-spinal anaesthesia hypotension that uses early treatment to prevent complications.
(ii) The authors administered 'phenylephrine 0.1%, 0.2 mg'. This is a relatively high dose to start with. The standard bolus dose of phenylephrine is 50–100 μg.
(iii) The authors combined phenylephrine, ephedrine, and atropine in a single category 'vasoactive drugs', and compared the rate of administration of these drugs as a single category between the two groups. Atropine has a different indication and effect than phenylephrine and ephedrine, and should not be combined in a single category.
(iv) The authors conducted a 'multivariate linear regression' to examine the influence of confounding factors on correlation between the IVC-CI and hypotension. Is this a valid method given that the dependent variable (hypotension rate) is dichotomous?
(v) The number (percentage) of patients who needed vasopressors in the control group was stated as 24 patients (30%) in the Results and 25 patients (31.25%) in Table 2.
(vi) The authors performed a linear regression model to study the correlation between IVC-CI and the total amount of administered fluid. By design, patients with a high IVC-CI received fluid preload until their IVC-CI decreased below 36%; hence, studying such a correlation is irrelevant.
(vii) In Figure 4 legend, the authors stated that 'For patients with Δ-IVC superior to 36% there was a slight correlation with the reduction in MAP after spinal anaesthesia (r^2=−0.16)'. Figure 4b signifies that patients with a higher IVC-CI developed a greater reduction in mean arterial pressure. This contradicts the main finding of the study.

In my opinion, the appropriate design to examine the value of IVC-CI to predict fluid responsiveness and guide fluid therapy in elective surgical patients undergoing spinal anaesthesia is to perform an observational study, in which a specific fluid therapy is administered to all patients and fluid responsiveness is assessed. Patients are then divided into two groups (fluid responders and non-responders), and baseline IVC-CI is compared between them and analysed for its diagnostic accuracy.

Author's contribution

The author M.M. Tawfik prepared the manuscript.

Declaration of interest

The author declares that they have no conflict of interest.

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Personalised anaesthesia: three-dimensional printing of facial prosthetic for facial deformity with difficult airway

S. Fan[#], A. Chan[#], S. Au, M. C.-W. Leong, M. Chow, Y.-T. Fan, R. Wong, S. Chan, S.-K. Ng, A. P. Lee[*,#] and K.-W. Kwok[#]

Hong Kong, China

*Corresponding author. E-mail: alexpwlee@cuhk.edu.hk

[#]Equal contribution to the manuscript.

Editor—Airway management in patients with congenital or acquired craniofacial deformities and a difficult airway poses significant challenges. The distorted morphology hinders conventional airway management techniques, and the highly variable presentation precludes development of standard equipment or protocols for managing these patients. Typical solutions such as inhalation induction and awake intubation[1,2] are often limited by these craniofacial abnormalities that impede secure face mask fitting and the possibility of emotional stress in patients with medical and surgical comorbidities. As craniofacial deformities vary widely in morphology and location, it is not practical to create 'one-

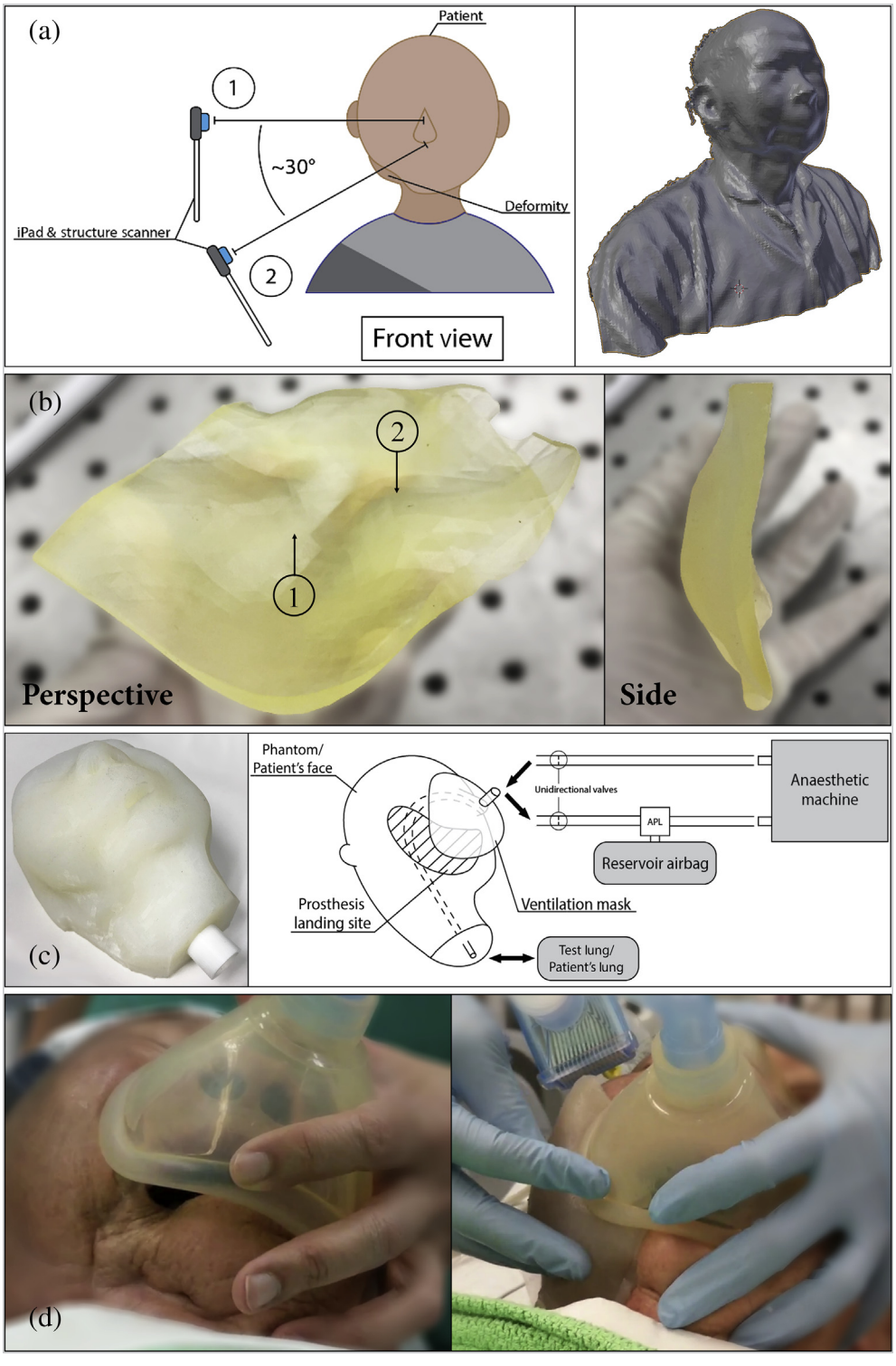

Fig 1. (a) Mobile scanning setup—three-dimensional scanner was manoeuvred in an arc motion centred around the patient in the displayed orientations to digitise the patient's face volumetrically. (b) Varying geometry of personalised prosthesis can accommodate different facial features [i.e. cheekbone (1) and deformity (2)]. (c) Closed circuit anaesthetic system setup for leakage test, using the phantom and patient's face. (d) Application of personalised prosthesis provided an anchoring platform for excellent mask contact, without concealing the mouth to allow detection of pharyngeal reflux or regurgitation.

size-fits-all' generic face masks. We have therefore devised and validated a highly-adaptable personalised solution by combining gradually accessible technologies of mobile three-dimensional (3D) scanning, computer-aided design (CAD), and high-resolution 3D printing.

As an example, a 73-yr-old patient who had undergone right mandibulectomy, right modified radical neck dissection, and free fibular flap reconstruction 19 yr ago because of carcinoma of the right lower alveolus was planned for an elective open repair of a descending thoracic aortic aneurysm. In addition to a Stanford Type B aortic dissection and hypertension, the patient had significant facial deformities and a difficult airway as a result of previous mandibulectomy and postoperative radiotherapy, including Mallampati Grade 3, short thyromental distance, depressed facial contour, and crowded submandibular space. Difficult mask ventilation and intubation was thus anticipated.[3] The complexity of induction of anaesthesia was increased by the operative requirement of one-lung ventilation.

A patient-specific prosthesis was produced upon receiving informed consent from the patient. By utilising multi-angle acquisition technique with mobile 3D scanning (Fig. 1a), a facial depth dataset was made with resolution and precision to 0.1 and 0.5 mm, and exported to CAD for device design. The prosthesis was modelled on the facial contour along the organic profile to facilitate contact of a standard ventilation mask. The skin-safe translucent personalised facial prosthesis was cast from an inverse mould fabricated from the 3D printed model using Ecoflex® 00-30 (Smooth-On, Inc., Macungie, Philadelphia, PA, USA; Fig. 1b). The model was printed by a high-resolution material jetting printer (Objet500 Connex3; Stratasys, Ltd., Eden Prairie, Minneapolis, MN, USA) to ensure accuracy.

Before use on the patient, the prosthesis was tested with a standard ventilation mask (Laerdal Medical, Stavenger, Norway) and personalised phantom face model to ascertain its ability to minimise leakage within a closed circuit anaesthetic system (Fig. 1c). The validated prosthesis was then applied on the patient for quantitative comparison with non-personalised prostheses. With gradual reductions of fresh gas flow, inflation of the reservoir bag and circuit pressure were maintained even at low fresh gas flow rate (1 L min^{-1}), and positive pressure ventilation was achieved without excessive insufflation pressure, suggestive of effective seal for positive pressure ventilation. Discrete pressure-volume loops were identified under fresh gas flows of 18 to 1 L min^{-1}only with application of personalised prosthesis, while incomplete/no pressure-volume loops were detected in circuits with the non-personalised or no prosthesis, indicating substantial air leakage. Identical outcomes were successfully replicated under intraoperative conditions by an anaesthetist independent of the development team. The presence of the prosthesis obliterated the gap between the Laerdal mask and the patient's native face (Fig. 1d), leading to adequate pre-oxygenation with 6 L min^{-1} fresh gas flow. Bag mask ventilation was readily achieved after induction of anaesthesia, and despite a Cormack-Lehane Grade 3 larynx seen on video-laryngoscopy, the airway was eventually secured with a double lumen tube and surgery progressed uneventfully. The patient was transferred to the ICU for postoperative monitoring, along with the personalised prosthesis in anticipation of post-extubation non-invasive ventilatory support.

Though similar techniques have been applied in other medical fields,[4] our novel personalised approach describes the first clinical application of 3D printing.[5] The approach was made feasible by the flexibility granted by 3D scanning and rapid prototyping of 3D printing, which facilitated iterative design and swift production of accurate complex organic geometries. Our device enabled maintenance of adequate oxygenation and ventilation throughout induction of anaesthesia, hence allowing gentle manipulation of the airway and insertion of a double-lumen tracheal tube while maintaining stable haemodynamics in a high-risk patient. The rapid production and testing of the personalised prosthesis within 5 days of scanning allowed for timely anaesthetic planning without surgical delay, and the production cost of $51 USD makes our highly-adaptable approach a practical and economical option. It stands as an effective and safer alternative for those with complex facial deformities and physiological conditions who would normally be faced with limited options for safe induction of anaesthesia and intubation.

Authors' contributions

Conceptualised and study design: A.L., R.W., K.W.K.
Responsible for the setup and device preparation of the test: S.F., M.C.W.L., M.C.
Data acquisition and analysis: S.F., A.C., S.A.
Writing paper: S.F., A.C.
Contributed critical revisions: A.L., Y.T.K., K.W.K., A.C., S.A., S.C., S.K.N.
Granted final approval of the version to be published and assume accountability as individuals for the final manuscript and its contents: all authors.
Guarantor: A.L.

Declaration of interest

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Fibreoptic tracheal intubation: blind or direct vision. Comment on Br J Anaesth 2018; 120:1139–40.

T. Kathirgamanathan

Watford, UK

E-mail: katnat36@hotmail.com

Editor—I read with interest the recent report in the *British Journal of Anaesthesia* about uvula necrosis after fibreoptic intubation by Budde and colleagues.[1] There are a few important points to consider with regard to the diagnosis and the mechanism of uvula necrosis during fibreoptic intubation. Minor complications caused by airway devices are not uncommon. Sore throat is one of the most common complications. Patients are informed about the most commonly occurring complications, including a sore throat, during the preoperative visit by the anaesthetist.

According to the authors,[1] initial insertion of the fibreoptic scope into the trachea was uneventful; however, they felt significant resistance in sliding the tracheal tube over the bronchoscope. In addition, they tried multiple unsuccessful repositioning manoeuvres in order to place the tracheal tube correctly. Sliding the tracheal tube over the scope is a blind procedure. It is important to highlight that any blind technique using airway devices including a tracheal tube is a potential risk factor in causing airway trauma. Trauma is more likely with significant resistance when handling airway devices including the tracheal tube.

Secondly, patients may not always complain about a sore throat or pain on the same day, especially if it was mentioned during the preoperative visit as one of the side-effects of intubation, and the incidence of sore throat is higher when asked directly. It is not clear if the authors were looking for sore throat or trauma on the day of the operation, as in this case they mentioned they had difficulties during intubation.

This case highlights the difficulties involved in blind insertion of a tracheal tube sliding over the fibreoptic scope, as it increases the likelihood trauma to the airway. It also highlights the importance of looking for complications after procedures, particularly if there were difficulties during the intubation process.

Is it safer to manipulate airway devices under direct vision? Would direct laryngoscopy have been safer than fibreoptic had there been no issue of difficult intubation in this case? It is not only important to monitor the intubation process continuously with direct laryngoscopy or videolaryngoscopy, but also to consider other devices such as ultrasound to confirm tube position in order to avoid complications such as prolonged impingement of the uvula.

Declaration of interest

The author declares that they have no conflict of interest.

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