anaesthesia with muscle paralysis and inhaled maintenance of anaesthesia. This strategy led to reduced propofol consumption and greater thiopental use, leading to greater familiarity with its use. This change in practice was possible because more experienced anaesthetists were able to teach junior anaesthetists about the use of thiopental. Thus, the current crisis allowed anaesthetists to (re)discover thiopental and its interesting properties: reliable hypnotic effect, short induction time, cardiostability, and slow recovery minimising awareness during induction of anaesthesia.

Ultimately, the question about the choice of hypnotic drug in modern anaesthetic practice should be: 'What is, for a given patient and intervention, the benefit/risk ratio of using a particular hypnotic drug for induction or maintenance of anaesthesia?', which takes into account both patient and surgery characteristics and cost of the drugs, whilst considering maintenance of sufficient skill for the use of various hypnotic drugs in anaesthesia. Propofol has some advantages over thiopental: it provides good intubating conditions without muscular relaxation and can be used for maintenance of anaesthesia without slowing recovery. But, in clinical practice, these characteristics of propofol are not essential or utilised for all patients. Another issue is the increased risk of medication error when using thiopental rather than propofol.[4] Medication errors are not infrequent in anaesthesia and involve several categories of drugs.[9] Reintroducing thiopental in the operating theatre could provide an opportunity to strengthen education and teaching focusing on drug preparation, labelling, and administration, contributing to improve practice and increase safety.[10]

The time to remove thiopental from anaesthetic practice, especially for Caesarean section, has not yet arrived. One must wonder whether it is desirable or beneficial that new generations of anaesthetists have become dependent on a single i.v. hypnotic drug for induction of anaesthesia.

Declarations of interest

The authors declare that they have no conflicts of interest.

References

1. Knight M, Kenyon S, Brocklehurst P, Neilson J, Shakespeare J, Kurinczuk JJ, on behalf of MBRRACE-UK. *Saving lives, improving mothers' care. Lessons learned to inform future maternity care from the UK and Ireland confidential enquiries into maternal deaths and morbidity 2009-12, Oxford* 2014
2. El-Orbany MI, Joseph NJ, Salem MR. Tracheal intubating conditions and apnoea time after small-dose succinylcholine are not modified by the choice of induction agent. *Br J Anaesth* 2005; **95**: 710–4
3. Bonnet MP, Mercier FJ, Vicaut E, Galand A, Keita H, Baillard C. Incidence and risk factors for maternal hypoxaemia during induction of general anaesthesia for nonelective Caesarean section: a prospective multicentre study. *Br J Anaesth* 2020; **125**: e81–7
4. Lucas DN, Yentis SM. Unsettled weather and the end for thiopental? Obstetric general anaesthesia after the NAP5 and MBRRACE-UK reports. *Anaesthesia* 2015; **70**: 375–9
5. Bouvet L, Stoian A, Rimmele T, Allaouchiche B, Chassard D, Boselli E. Optimal remifentanil dosage for providing excellent intubating conditions when coadministered with a single standard dose of propofol. *Anaesthesia* 2009; **64**: 719–26
6. Fuchs-Buder T, Claudius C, Skovgaard LT, Eriksson LI, Mirakhur RK, Viby-Mogensen J. Good clinical research practice in pharmacodynamic studies of neuromuscular blocking agents II: the Stockholm revision. *Acta Anaesthesiol Scand* 2007; **51**: 789–808
7. Desai N, Wicker J, Sajayan A, Mendonca C. A survey of practice of rapid sequence induction for caesarean section in England. *Int J Obstet Anesth* 2018; **36**: 3–10
8. Velly L, Gayat E, Quintard H, et al. Guidelines: anaesthesia in the context of COVID-19 pandemic. *Anaesth Crit Care Pain Med* 2020; **39**: 395–415
9. Gariel C, Cogniat B, Desgranges FP, Chassard D, Bouvet L. Incidence, characteristics, and predictive factors for medication errors in paediatric anaesthesia: a prospective incident monitoring study. *Br J Anaesth* 2018; **120**: 563–70
10. Risk Management Analysis Committee of the French Society for Anesthesia and Critical Care (SFAR); French Society for Clinical Pharmacy (SFPC). Preventing medication errors in anesthesia and critical care (abbreviated version). *Anaesth Crit Care Pain Med* 2017; **36**: 253–8

doi: 10.1016/j.bja.2020.08.004
Advance Access Publication Date: 28 August 2020

The superficial femoral artery: a novel site for arterial access

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Keywords: arterial catheter; blood pressure; monitoring; superficial femoral artery; ultrasonography

Editor—The common femoral artery (CFA) is frequently used for insertion of peripheral arterial lines, particularly when access to upper limb vessels is restricted. The advantages of using the CFA include its large lumen, reliable landmarks, and close representation of the aortic pressure.[1] CFA catheters are also thought to be less easily displaced and have a lower failure rate compared with radial artery catheters.[2] However, there are also disadvantages to the CFA approach including a deeper course compared with the radial artery and a higher risk of local and systemic sepsis consequent to its proximity to the perineal area.[3] In obese patients, excess abdominal tissue may make insertion of a femoral arterial line more challenging. Injury to the femoral nerve, the major innervation of the anterior compartment of the thigh, has also been reported in up to 0.2% of cases secondary to haematoma, pseudoaneurysm, or injury after CFA line insertion.[4,5]

Immediately distal to the inguinal ligament the CFA bifurcates into the deep femoral (profunda femoris) artery and the superficial femoral artery (SFA). The SFA traverses the adductor canal giving off minor branches to the muscles of the thigh finally emerging from the adductor hiatus as the popliteal artery. With the introduction of ultrasonography into routine clinical practice the SFA has become a viable option for arterial line insertion when traditional approaches are unavailable. Using a high-frequency (6–13 MHz) linear transducer, the SFA can be viewed in a transverse or longitudinal orientation immediately posterior to the sartorius muscle. The SFA can be accessed with the introducer needle being viewed out-of-plane or in-plane (Supplementary Files 1–3). A longer needle and catheter may be required owing to the location of the SFA immediately inferior to the sartorius muscle by 3–4 cm depending on body habitus (Supplementary Files 1–3).

The SFA offers several advantages for arterial line insertion including its large lumen and consistently straight course within the adductor canal, which is ~15 cm long (Supplementary File 2). Although the mean lumen diameter of the SFA is 6.0 [0.12] mm, its smaller lumen in comparison with the CFA (8.2 [0.14] mm) might increase the risk of thrombotic complications, although there is no evidence to support this.[6] The diameter of the SFA is significantly larger than that of the radial and brachial arteries (2.1 [0.4] mm and 3.9 [0.5] mm, respectively), which are commonly used for vascular access.[7,8] There is some evidence of superiority or non-inferiority of using the SFA for arterial line insertion compared with the CFA. In a randomised trial of patients undergoing endovascular interventional treatment, accessing the SFA was more successful (49/50 patients) compared with 41/50 patients in the CFA group [P=0.016] and faster (3 min 25 s) compared with puncturing the CFA (5 min 26 s) [P<0.001].[9] However, pseudoaneurysm was more common after SFA line insertion (8/49 patients) and manual compression compared with the CFA (1/41patients) [P=0.036].[9] Insertion at the level of the mid-thigh allows the SFA line to be safely secured and more easily accessed (Fig. 1). Puncturing the SFA distal to the perineum may also be expected to reduce the incidence of local infection and sepsis compared with the CFA although there is no current evidence to support this.[9] Significant neurological disability secondary to haematoma, pseudoaneurysm, or injury may also be reduced by using the SFA approach. Unlike the femoral nerve, the saphenous nerve lying immediately lateral to SFA in the mid-thigh has no motor function but has a purely sensory role innervating the skin of the medial aspect of the lower leg.

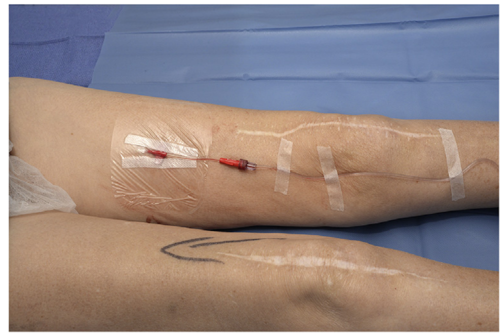

Fig 1. An arterial catheter within the superficial femoral artery at the level of the mid-thigh.

Ultrasound-guided SFA catheter insertion at the level of the mid-thigh may offer an alternative option for arterial access when traditional approaches to the upper and lower limbs are unavailable.

Declarations of interest

The author declares that they have conflicts of interest.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.bja.2020.08.022.

References

1. Soderstrom CA, Wasserman DH, Dunham CM, Caplan ES, Cowley RA. Superiority of the femoral artery for monitoring. A prospective study. *Am J Surg* 1982; **144**: 309–12
2. Greer MR, Carney S, McPheeters RA, Aguiniga P, Rubio S, Lee J. Radial arterial lines have a higher failure rate than femoral. *West J Emerg Med* 2018; **19**: 364–71
3. Scheer BV, Perel A, Pfeiffer UJ. Complications and risk factors of peripheral arterial catheters used for haemodynamic monitoring in anaesthesia and intensive care medicine. *Crit Care* 2002; **6**: 198–204
4. Kent KC, Moscucci M, Gallagher SG, DiMattia ST, Skillman JJ. Neuropathy after cardiac catheterization: incidence, clinical patterns, and long-term outcome. *J Vasc Surg* 1994; **19**: 1008–13
5. Seto AH, Abu-Fadel MS, Sparling JM, et al. Real-time ultrasound guidance facilitates femoral arterial access and reduces vascular complications: FAUST (Femoral Arterial Access with Ultrasound Trial). *JACC Cardiovasc Interv* 2010; **3**: 751–8
6. Crisan S. Ultrasound examination of the femoral and popliteal arteries. *Med Ultrason* 2012; **14**: 74–7
7. Shao E, Vaghadia H, Ramsay N, Tang R, Sawka A. Evaluation of two novel techniques for increasing radial artery size: a pilot study utilizing volunteers. *Can J Anesth* 2017; **64**: 786–7
8. Tomiyama Y, Yoshinaga K, Fujii S, et al. Accurate quantitative measurements of brachial artery cross-sectional

vascular area and vascular volume elastic modulus using automated oscillometric measurements: comparison with brachial artery ultrasound. *Hypertens Res* 2015; **38**: 478–84

9. Gutzeit A, Graf N, Schoch E, Sautter T, Jenelten R, Binkert CA. Ultrasound-guided antegrade femoral access: comparison between the common femoral artery and the superficial femoral artery. *Eur Radiol* 2010; **21**: 1323–8

doi: 10.1016/j.bja.2020.08.022
Advance Access Publication Date: 18 September 2020

Airway management in space: a novice skill?

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Keywords: microgravity; simulation; skill acquisition; tracheal intubation; videolaryngoscopy

Editor—We enjoyed discussing the work of Starck and colleagues[1] at our recent virtual journal club based at the North West School of Anaesthesia, UK. We were fascinated to learn about research in parabolic flight microgravity and congratulate the authors on conducting a challenging study to compare simulated tracheal intubation using direct and videolaryngoscopy by experts and novices. The study concluded that there was no significant difference between novices and experts using a McGrath videolaryngoscope (Medtronic, Dublin, Ireland) when intubating the 'trachea' of a SimMan ALS manikin (Laerdal, Stavanger, Norway) in simulated microgravity. The accompanying editorial[2] raises some excellent points around the methodology of this study, to which we would like to add. Furthermore, we have some observations concerning skill acquisition and retention, which may offer some explanation for the interesting and perhaps surprising findings in Starck and colleagues'[1] paper.

Firstly, we wish to draw attention to the role of the airway assistant. It was important to include 'novice' participants in Starck's[1] study because long-duration spaceflights involve a not-inconsiderable risk of a medical emergency necessitating airway management. If required, this would need to be undertaken by members of the crew who may not be medically trained or experienced in tracheal intubation. Furthermore, because of the distances involved, real-time guidance from an expert on Earth would be impossible, so self-sufficiency would be required. We note, however, that whilst novices undertook the intubation attempt on 50% of occasions, the assistant for all attempts was described as an 'expert'. The role of the anaesthetic assistant is vital in emergency airway management, including providing equipment in an appropriate fashion, decision support, identification and mitigation of airway problems, and providing a degree of supervision for inexperienced anaesthetists.[3,4] Although this study simulated only a single task with little requirement for decision making, we wonder if the involvement of an expert assistant may have improved the chances of success in comparison to what may reasonably be expected in the spaceflight context.[1]

Secondly, we question the definition of 'failure' in Starck and colleagues'[1] study, which comprised misplacement of the tracheal tube (including endobronchial intubation), or a procedural duration that exceeded the duration of the parabola (25 s).[1] Whilst problems such as unrecognised oesophageal intubation clearly do represent 'failure', we question the appropriateness of this binary classification in other circumstances. Endobronchial intubation, for example, is easily rectified and can be lifesaving in an airway emergency. With this in mind, it would have been useful to know the reasons for failed intubation. Given the limited data that are presented it is possible, for example, that videolaryngoscopy mitigated the risk of endobronchial intubation as a result of improved visualisation of the tube markings, but that the results were otherwise the same.

Thirdly, the way in which skill levels are defined requires consideration. Whilst Starck and colleagues'[1] definition of 'experts' (>1000 tracheal intubations) is uncontroversial, defining those having completed less than 10 intubations before the study as 'novices' may not be accurate. The Dreyfus and Dreyfus model of skill acquisition defines five levels of skill: novice, advanced beginner, competent, proficient, and expert.[5] According to this system, novices lack the benefit of contextual knowledge. However, the less experienced participants in this study could reasonably be expected to have acquired this as a consequence of both prior intubation experience and the training course (including four tracheal intubations) provided as part of the study.[1] Relatively little experience is required to rapidly move through lower skill levels. It should therefore be considered whether the theoretical maximum of 13 intubations that 'novices' could have undertaken before the start of data collection may have