Comparing different methods of cardiac output determination: a call for consensus

EDITOR:
We read the article by Dr Bajorat and colleagues reporting their results with different methods of cardiac output (CO) determination with great interest [1]. The authors should be commended for this study having for the first time compared a broad array of clinically used methods of CO determination to a true reference standard, i.e. aortic transit time ultrasound. However, though their approach is ambitious, some methodological remarks are necessary.

Firstly, the authors suggest that pulmonary arterial and transpulmonary thermodilution can be used interchangeably for CO determination even under acute haemodynamic changes. This conclusion is not supported by the data presented. Following the introduction of Bland Altman plots for method comparison in 1986 [2], for more than a decade the judgement of bias and limits of agreement was left to the clinician, and identical values were interpreted differently. The pivotal work by Critchley for the first time suggested a comprehensive mathematically derived criterion for assessment of observed variability [3]. Given an inherent variability of ±20% for each method under comparison, the combined variability (i.e. limits of agreement) should not exceed ±30% of the mean CO. Applying these strict criteria to the data, only transpulmonary thermodilution (defined as high flow conditions of CO > 4 L min⁻¹) was really interchangeable with the reference method.

Secondly, the authors calculated a trend score to determine if the different methods investigated track changes of the instantaneous CO consistently. Despite the fact that this score does not account for a situation when one method yields an increasing or decreasing CO, respectively, while the other method yields an unchanged reading, the fruitful discussion following a publication reporting on the comparison of pulse contour derived CO measurements suggests analysis of the change in CO after a specific intervention also with a Bland Altman plot, comparing the mean percent change of both methods against the difference [4]. This analysis reveals quickly if methods under comparison do track ensuing changes of CO in a comparable fashion.

Thirdly, in this regard it would be of great interest how the pulse contour derived CO performed during the various interventions reported. Since the authors used the PiCCO® for transpulmonary thermodilution, these values could have been easily obtained. Unfortunately, there are no data provided with regard to the pulse contour CO throughout the study period. This is quite surprising since data regarding the performance of pulse contour derived CO determination during rapid haemodynamic changes are currently still lacking. Finally, to facilitate comparison of different studies, we would suggest a consensus for data analysis and interpretation. Judgement of bias and limits of agreement should be based on Critchley's recommendations and the analysis of CO changes should also be accomplished with a Bland Altman plot.

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References
An unusual case of airway obstruction

EDITOR:
The management of the case described by Brimacombe and Keller [1] calls for comment. Although the patient refused awake tracheal intubation, there was an ample time for counselling. A second team member could have approached the patient and further discussed available options. It is important to realize that it is not always the doctor with the most technical expertise who is the best counsellor. There are compelling reasons to advocate awake tracheal intubation when management of the airway is expected to be difficult.

As the induction in the above case was performed with midazolam, propofol and alfentanil spontaneous breathing was lost. This contradicts the basic principle that the natural airway is better maintained when the patient remains breathing spontaneously [2].

Inhalational induction with sevoflurane in 100% oxygen would, in my opinion, have been a better option [3]. A further question concerns the use of atracurium in the above situation. As ventilation was impossible in this case with high airway pressures and airway obstruction, instead of re-inserting the laryngeal mask or moving to face mask ventilation waking up the patient, or even considering a surgical airway (if they had the expertise), the authors enthusiastically followed their own rather complicated algorithm which, by their words, ‘failed to solve the problem’. Finally they secured the airway, but valuable time was wasted. Obese patients have reduced functional residual capacity, increased minute ventilation and increased oxygen demand, and can rapidly desaturate.

Although, each case of difficult airway must be assessed on its individual merits and the balance of priorities, securing the airway with the patient anaesthetized and not breathing spontaneously is more hazardous [4]. Awake fibreoptic [5] or inhalational induction is safer option. I personally would not advise my colleagues to follow the path chosen by Brimacombe and Keller. In the situation of cannot intubate/ventilate, the best option is to keep it simple.

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References

Reply

EDITOR:
Dr Kotsev’s comments seem to stem from an archaic attitude towards airway management and a failure to grasp the importance of bougie-guided insertion of the ProSeal laryngeal mask airway for airway rescue [1,2]. We will address each of his points in turn.

First, this patient was reviewed both by a second anaesthetist and a clinical psychologist who found that he had a rational fear of awake intubation: his brother had undergone a rather gruesome awake intubation for an elective cholecystectomy (on the basis of having buck teeth and a beard) which left him with a vocal cord injury.

Second, spontaneous breathing was not lost after induction. We took over the patient’s ventilation to allow better gas exchange and to deepen anaesthesia. Having established successful ventilation, we felt it was safe to administer a muscle relaxant. It is debatable as to whether suxamethonium would have been a better choice than atracurium.

Third, the principle that ‘the natural airway is better maintained when the patient remains breathing spontaneously’ makes little sense and is almost
certainly wrong. The natural airway is usually lost once the patient is anaesthetised and gas exchange is usually worse with spontaneous rather than positive pressure ventilation. Other than providing information about depth of anaesthesia and perhaps reducing the frequency of gastric insufflation and barotrauma, spontaneous breathing under anaesthesia is neither natural nor beneficial.

Fourth, the concept that inhalational anaesthesia is best if airway problems are anticipated is entrenched in anaesthesia teaching, yet few clinicians adhere to it and it remains (and probably always will be) unproven. The primary benefit of inhalational induction is that if problems arise they occur slowly and can easily be reversed — but is this true? More importantly, can these problems be reversed more rapidly than after an intravenous induction with modern short acting agents? There is no answer. Certainly, most of us have experienced horrendous gas inductions in adults.

Fifth, it took less than 20 s to work through the section of the algorithm which relates to guided insertion techniques, and a further 10 s to remove the ProSeal laryngeal mask airway and railroad the tracheal tube into position. Thus we wasted no time in securing the patients airway. The minimal $S\text{O}_2$ was 94%. Our algorithm is not particularly complex: it certainly has fewer steps than the American Society of Anesthesiologists difficult airway algorithm.

Sixth, we do not consider that there are compelling reasons to perform awake tracheal intubation in a patient with a history of difficult tracheal intubation if other forms of airway management have proved to be easy. In this case, face mask ventilation was known to be easy (admittedly it required a Guedel airway) and there were no signs that laryngeal mask airway insertion/function would be difficult. Certainly, if both face mask ventilation and laryngeal mask airway insertion are predicted to be easy, it is difficult to justify awake tracheal intubation, especially against a patient’s wishes.

Finally, all anaesthesiologists should familiarise themselves with the bougie-guided technique for insertion of the ProSeal laryngeal mask airway. It is a powerful yet simple new concept in airway management: using a tube that is easily accessible (the oesophagus) to secure access to a tube that is not easily accessible (the trachea). The combination of the best extraglottic device with this new technique for placement results in remarkably high insertion success rates. In our experience of over 15 000 uses, it has a failure rate of 0.5% falling to 0.1% after the application of the algorithm. We recently found that even personnel with no experience of airway management have exceptionally high success rates (100 out of 100 patients) following brief manikin-only training [3]. In our view, it is one of the most successful airway management techniques in anaesthesia practice today and our algorithm further increases its success.

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References


Tracheal intubation without muscle relaxants: large doses of opioids, small endotracheal tubes

EDITOR:
We have read with great interest the article by Baillard and colleagues in the September 2005 issue of the European Journal of Anaesthesiology entitled ‘Tracheal intubation in routine practice with and without muscular relaxation: an observational study’ [1].

In the discussion, the authors underline the importance of the choice of the hypnotic agent, namely propofol, and of the dose of propofol to administer to obtain acceptable intubation conditions when muscle relaxants are omitted. However, it would have been
interesting to mention that opioid agent and its dose are probably also important factors. It has been shown that doses of remifentanil in excess of 2 µg kg⁻¹ when given with propofol 2 mg kg⁻¹ are required to obtain excellent intubating conditions in more than 80% of patients [2]. Doses of remifentanil greater than 3 µg kg⁻¹ are required when given with thiopental 5 mg kg⁻¹ [3]. In the same way, Saarnivaara and Klemola showed that significantly better intubating conditions were obtained with the combination of alfentanil 30 µg kg⁻¹ and propofol 2.5 mg kg⁻¹ than with propofol 2.5 mg kg⁻¹ alone or associated with alfentanil 20 µg kg⁻¹ [4]. In the present study, the dose of sufentanil administered was limited to 0.2–0.4 µg kg⁻¹ whereas the dose of propofol was at the discretion of the attending anaesthesiologist. Hence, it is not surprising that significantly increased doses of propofol were administered in patients intubated without a muscle relaxant. Nevertheless, it is interesting to note that doses of sufentanil were also significantly higher in the relaxant-free intubation group.

In Baillard and colleagues work, no difference between-groups were observed concerning the incidence of postoperative sore throat and vocal cord sequelae. This data questions the conclusions of Mencke and colleagues in their study published in 2003, showing that intubation without use of a muscle relaxant may result in more laryngeal damage [5]. Moreover, these authors reported incidences of postoperative hoarseness and vocal cord sequelae in both relaxant-free and relaxant-intubation groups much higher than in the study conducted by Baillard and colleagues. Thus, vocal cord sequelae were found in only 4 patients out of 565 in the work by Baillard and colleagues, whereas Mencke and colleagues reported incidences of 42% in the relaxant-free intubation group and 8% in the relaxant-intubation group. These large differences could certainly be explained by the use of relatively small endotracheal tubes (7.5 mm for men and 7 mm for women) by Baillard and colleagues, whereas larger endotracheal tubes (8.5 mm for men and 7.5 mm for women) were used in the study conducted by Mencke and colleagues. It is well known that the size of tube is a significant contributor to the occurrence of laryngeal damage. Stout and colleagues showed that the incidence and severity of postoperative hoarseness and sore throat after endotracheal intubation are significantly reduced by using smaller tubes (7 mm for men and 6.5 mm for women) than larger (9 mm for men and 8.5 mm for women) [6], without any major effect on parameters of ventilation [6,7]. Hence, it would have been of interest that the authors discussed the relative small size of endotracheal tubes used in their study, which probably constituted a significant factor explaining the low frequency of laryngeal complications reported in their paper compared to other studies.

In conclusion, tracheal intubation without use of muscle relaxants may be efficiently and safety performed when both large doses of opioids and small endotracheal tubes are used.

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References

Reply
EDITOR:
We thank Dr Bouvet and colleagues for their comments. The safety of routine tracheal intubation (i.e. laryngeal morbidity) with or without the use of muscle relaxants needs to be optimized [1]. We have examined something close to routine clinical practice and there is no doubt that intubation conditions, when omitting muscle relaxants, may be further improved by the use of other opioids (e.g. alfentanil or remifentanil) or hypnotic (e.g. sevoflurane) agents [2]. Nevertheless, our study was a practical means to obtain relevant information about our clinical
Correct sizing of the CobraPLA is necessary for valid study results

EDITOR:
We read with interest the study by Turan and colleagues comparing the laryngeal mask airway (LMA) and laryngeal tube (LT) with the perilyngeal airway (CobraPLA) in short surgical procedures [1]. Although the authors were able to successfully place the CobraPLA in a remarkably high percentage of patients after experience with only 20 practice insertions, their patients suffered a relatively high incidence of blood traces on the device (50%) and sore throat (50%). The investigators attributed this incidence to the rigidity of the CobraPLA head, a design feature that allows soft tissues to be stented away from the glottis.

We believe a more likely explanation is that, in many patients, CobraPLAs that were too large for the patients were used in the study. If a size which is too large for any given patient is inserted it is logical to assume a greater likelihood of trauma resulting.

Turan and colleagues used CobraPLA size 3 for patients weighing under 60 kg, size 4 for patients 60–80 kg, and size 5 for patients over 80 kg. Thus they limited the weights of patients in whom the smaller sized CobraPLAs could be used. However, the packaging for each CobraPLA clearly states that ‘proper size is critical for effective insertion and function, smaller is usually better’. In addition, CobraPLA size 5 is intended for patients weighing over 100 kg, not 80 kg.

Further, there is no upper limit of patient size or weight for any given CobraPLA. For example, as the packaging for the size 3 CobraPLA states that it is intended for use in patients >35 kg, one of us (D.D.A.) has used a size 3 in a 130 kg patient.

We believe that if a smaller size was used in some patients, considerably less trauma would have resulted.

In support of this belief is a recent study by Gaitini and colleagues comparing CobraPLA with the LMA Unique® during spontaneous ventilation [2]. Those authors used CobraPLAs sized ‘according to manufacturer’s recommendations’ [2] and found an incidence of 15% blood staining and 10% sore throat. Both of these figures were less than with the LMA but did not reach statistical significance. Although the patients receiving CobraPLAs in Turan’s study were paralysed and those in the Gaitini study [2] were not, there is no reason to believe that non-paralysed patients, in whom muscle tone is present and which might impede device placement, would experience less traumatic insertion.

Conflict of interest
D. D. Alfery is the inventor of the CobraPLA.

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References
Fascia-iliaca compartment block for femoral bone fracture in prehospital medicine in a 6-yr-old child

EDITOR:
The fascia-iliaca compartment block (FICB) was first described by Dalens and colleagues [1]. In other studies, authors confirmed the efficacy of FICB for postoperative pain management in children [2], and in adults [3,4]. The advantages of this technique include the ability to perform the block without nerve stimulator, a point of puncture distant from the neurovascular structures and adequate block efficacy with a single injection [3,5]. The efficacy of FICB has been well studied in prehospital care in the French medical system (physicians are present in prehospital units in France) [6–8]. However, the use of the FICB in prehospital care in paediatrics has never been reported. We report and discuss the case of a 6-yr-old female with a femoral bone fracture due to a fall through the window, who benefited of a single injection FICB.

A 6-yr-old, 26-kg female, without past medical history, was victim of an accident having fallen through a window from the third floor. At the arrival of the medical team, the female lay supine on the floor. Standard monitoring was applied and she was haemodynamically stable (heart rate 140 min⁻¹, arterial pressure 120/60 mmHg), oxygen saturation 98% without oxygen, she was conscious (Glasgow Coma Scale = 15) and no neurological deficit was observed. The spine was not tender; abdominal palpation was unremarkable, cardiac and pulmonary auscultation was without abnormality. Femoral bone fracture was strongly suspected because of the lower limb deformation and the localization of the pain. Peripheral venous access (20-G) was established, and 450 mg of paracetamol was slowly infused. Nasal oxygen was given (5 L min⁻¹).

Objective pain scale (OPS) was 7 [9]. A FICB was performed using the technique previously described by Dalens and colleagues [1]. A projection of the inguinal ligament was drawn on the skin and trisected. The point of puncture was marked 0.5 cm caudal to the point at which the lateral met the middle third of the inguinal ligament line. After antiseptic preparation of the area, the block needle (Plexufix® 50 mm, 24-G) was inserted at a right angle to the skin. The first loss of resistance was felt as the needle’s tip crossed the fascia lata. The needle was advanced further with the same angle until the second loss of resistance was felt as the fascia iliaca was pierced. Fourteen milliliter (0.5 mL kg⁻¹) of 1.5% lidocaine with 1/400 000 epinephrine, was slowly injected over a 2-min period. Block efficacy was assessed by testing sensory block in the medial, lateral and anterior part of the thigh using pinpick and cold (alcohol on a cotton compress). OPS was 0 after the procedure. Block was successful after 10 min. The leg was therefore immobilized without pain or grimace and the child was brought to the emergency department without pain or discomfort. Radiography of the lower limb confirmed a middle femoral bone fracture. She underwent orthopaedic surgery the day after the trauma and was discharged from the hospital few days later.
In France, physicians are present in the prehospital unit, and some of them are anaesthesiologists. Thus, they transfer their knowledge from the hospital to this particular spot, as regional anaesthesia. The aim of regional anaesthesia in prehospital medicine is to assure adequate analgesia allowing fracture reduction, leg immobilization, transport to the emergency department and radiographic diagnosis without pain. In this case report, 1.5% lidocaine with epinephrine was used in this single injection technique to avoid any interference with subsequent anaesthesia for the surgery. Moreover, the type of local anaesthetic solution and its concentration is still matter of debate in children for FICB [2,10]. Finally, fast onset and low toxicity made lidocaine a good anaesthetic solution in prehospital care especially for a single injection technique.

We and Lopez and colleagues described the feasibility of FICB for adults in prehospital setting [6,8]. Nevertheless, no conclusion can be drawn for paediatric patients. One interest of this case report is the feasibility of FICB for femoral bone fracture in children at the scene of trauma. The FICB allowed the child to be calmed down without the need for sedation (OPS = 0 after the block). FICB permitted to keep continue verbal contact allowing transporting the child in good conditions to the hospital. However, in our case it was a co-operative child, it may be more difficult with an agitated one where sedation is required.

FICB is an adequate tool in a prehospital setting because this non-stimulated technique is easy to perform, safe and inexpensive. Nevertheless, complications have been described anecdotally [11], and we have to keep in mind that regional anaesthesia must be performed carefully with adapted surveillance [12]. As a nerve stimulator is not available in ambulances, this should be an effective method to obtain a lumbar plexus blockade. Moreover, some physicians in prehospital units in France are generalist physicians, so they don’t have the right to use a nerve stimulator [6,13].

In summary, we report a successful FICB in a child performed by an anaesthesiologist in a prehospital unit. The block allowed transporting the child easily without any pain or discomfort.

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References
Morphine and methylprednisolone after knee surgery

EDITOR:
We are writing to respond to the article by Kizilkaya and colleagues [1]. We feel that while the combination of methylprednisolone and morphine would appear to provide good postoperative analgesia following arthroscopic knee surgery, the authors do not stress the significance of the potential for septic arthritis following intra-articular steroid injection.

While none of the subjects who received steroid injection in the above study developed postoperative joint infection, the phenomenon is well described in the literature. Armstrong and colleagues analysed the risk factors associated with septic arthritis following 4256 arthroscopic procedures and found the most significant risk factor to be intraoperative injection of methylprednisolone [2]. Gosal and colleagues, cite six cases of septic arthritis in an 18-month period in 1999, all following intra-articular injection of steroid intraoperatively [3]. They conclude that the benefit of intra-articular steroid injection is unclear, while the risk of infection is very real.

The authors describe the injection of 5 mg of morphine to be as effective as the combination therapy without posing the additional infection risk. The addition of clonidine to the morphine is also described as a safe alternative and may be a preferable alternative. This latter technique is favoured in our institution.

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