



Editorial

Critical events in paediatric anaesthesia: Lessons learned from the APRICOT study's French data



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If the risks of anaesthetic tend to decrease regularly, they still remain higher in children than in adults, especially in younger children [1]. The switch from halothane to sevoflurane in paediatric anaesthesia initiated almost thirty years ago is probably the most important factor involved in the improvement of paediatric anaesthetic safety [2]. Beside drugs improvement, technological progress leading to more and more sophisticated and miniaturised sensors have allowed anaesthesia providers to understand the pharmacodynamic effects of the drugs used [3,4]. Clinical guidelines, based on published scientific studies, have been written and disseminated to improve patient management by avoiding the drift of practices in the most common situations. For instance, the anaesthetic management of children with airway susceptibility has been widely investigated [5,6] and some simple rules have been established [7]. Surgical practices have also been standardised and 3D virtual simulation keeps improving the safety of surgical procedures. Having made the checklist mandatory has allowed reducing serious mistakes, such as surgical procedure performed on the wrong side or in the wrong patient. Therefore, the rates of perioperative morbidity and mortality have sensibly decreased in the last thirty years.

Nevertheless, in the large recent prospective multicentre observational European study (APRICOT), the incidence of perioperative severe critical events was 5.2% [8]. A severe critical event was defined as the occurrence of respiratory, cardiac, allergic, or neurological complications requiring immediate intervention leading (or could have led) to major disability, or death, or drug error administration. In this issue of ACCPM, Dahmani et al. have separately analysed the data from the 33 French centres participating to the APRICOT study [9]. The authors report an incidence of perioperative severe critical events

reaching 6.2%. The first finding of this publication is that when they are prospectively collected, critical events appear to be relatively frequent in paediatric anaesthesia in France. In the princeps APRICOT study, authors calculated that one in six children presenting a critical event needs supplemental treatment or extended hospitalisation. Applied to the French data, it is estimated that more than 1% of anaesthetised children require medical intervention or prolonged length of hospital stay. If comparison of complication rates between France and European countries is hazardous because of differences in healthcare organisations and care providers educational backgrounds, practices in French centres could nonetheless be questioned when it is reported that more than 20% of included patients were not monitored according to recommendations. The fact that occurrence of laryngospasm is twice as frequent during induction in the French cohort compared to the whole APRICOT cohort (0.89% vs. 0.42%) also raises questions. Regarding the relatively high rate of critical events highlighted in the French study, the main question could be: which part of these complications can be classified as avoidable? In each department of anaesthesiology, severe complications should be carefully considered and retrospectively analysed to improve practices. It is widely demonstrated that such a quality approach can reduce complications. In children, hypotension, desaturation, bradycardia and laryngospasm are relatively frequent and often yet considered as “normal” complications intrinsic to paediatric anaesthesia, explained by physiological particularities, neonatal pathologies or surgical complexity. Moreover, these events are often considered as uneventful knowing that most of them are rapidly resolved. Toxicity of general anaesthetics has probably few clinical significance in smaller toddlers, but it is probably partly because classical adverse events of anaesthesia are relatively well managed; avoiding them is therefore a preventive crucial objective [10]. Recognising as “adverse events” these critical situations could help us better report, investigate and analyse them, and finally reduce their occurrence.

In France, patient safety is rapidly growing, encouraged by governmental recommendations (*Haute Autorité de Santé*, High Health Authority). If it cannot be denied that patient safety culture needs to be developed in France, it is clear that for the organisation of anaesthesia and operative theatre, another pillar of care security, France is at the forefront. This is the second lesson of this study. Nearly 84% of children had preoperative consultation, *versus* only 59% in the whole APRICOT dataset. Like a flight plan for airplanes

pilots, this preparation is essential to reduce anaesthetic risk and legally binding in France since 1994.

Another observation is that 88% of anaesthesia procedures were provided by an anaesthesia team associating an anaesthesiologist and a qualified nurse anaesthetist. European data were not available for comparison, but in the multivariate analysis, the lack of specialised nurses was associated with a significant higher rate of complications (33% vs. 20%, $P < 0.001$), which is not a surprising result, as every physician knows that working with a trained nurse anaesthetist strengthens safety of anaesthesia. Indeed, nurse anaesthetists are specifically qualified and benefit from an effective teaching including practical and theoretical features about anaesthesiology. Associated to the anaesthesiologist, nurse anaesthetists and their large experience in the operating theatre allow continuous qualified presence and rapid adapted response when a complication occurs [11]. A recent study in adults has shown that the combination of an anaesthesiologist and a nurse anaesthetist was associated with decreased 30-day complications compared with a solo anaesthesiologist [12]. However, these skills are expensive and in a public funding health system, it is necessary to demonstrate the improvement provided by the presence of nurse anaesthetists. Dahmani et al. provide grist to the mill of those who defend the anaesthetic community, like the Paediatric Association of French-speaking Anaesthetists and Intensivists (ADARPEF), which recommends the presence of an anaesthesiologist and a nurse anaesthetist during induction and awakening in paediatric anaesthesia. Human resources in the subspecialty appear essential to maintain quality of care, and French organisation could be considered as an interesting model. Furthermore, as already demonstrated in this study [13], the anaesthesiologist's experience in paediatric practice was associated with lower rate of complications. These findings underline the importance of the volume of paediatric cases managed by the anaesthesiologist, even if there is no limit on the number. Theoretical and practical continuous medical education focused on paediatric anaesthesia is also probably essential to maintain and update the quality of care.

Basically, this secondary analysis of the APRICOT study focused on French data provides important arguments in favour of maintaining or reinforcing the actual organisation of the anaesthetic care. Nevertheless, some progress is still needed to recognise our weaknesses, especially by analysing the occurrence of each unexpected critical event. We know our strengths, we know our weaknesses, thus we can still progress to improve safety of paediatric anaesthesia.

Disclosure of interest

The authors declare that they have no competing interest.

References

- [1] Westerkamp AC, de Geus AF, Molenbuur B, Meyer P, Wietasch JKG, Struys MMRF, et al. Comparing peri-operative complications of paediatric and adult anaesthesia: A retrospective cohort study of 81267 cases. *Eur J Anaesthesiol* 2018;35(4):280–8.
- [2] Michel F, Constantin J-M. Sevoflurane inside and outside the operating room. *Expert Opin Pharmacother* 2009;10(5):861–73.
- [3] Constant I, Seeman R. Inhalational anaesthetics in pediatric anesthesia. *Curr Opin Anaesthesiol* 2005;18(3):277–81.
- [4] Conti A, Iacopino DG, Fodale V, Micalizzi S, Penna O, Santamaria LB. Cerebral haemodynamic changes during propofol-remifentanyl or sevoflurane anaesthesia: transcranial Doppler study under bispectral index monitoring. *Br J Anaesth* 2006;97(3):333–9.
- [5] von Ungern-Sternberg BS, Boda K, Chambers NA, Rebmann C, Johnson C, Sly PD, et al. Risk assessment for respiratory complications in paediatric anaesthesia: a prospective cohort study. *Lancet Lond Engl* 2010;376(9743):773–83.
- [6] Michel F, Vacher T, Julien-Marsollier F, Dadure C, Aubineau J-V, Lejus C, et al. Peri-operative respiratory adverse events in children with upper respiratory tract infections allowed to proceed with anaesthesia: a French national cohort study. *Eur J Anaesthesiol* 2018;35(12):919–28.
- [7] Dadure C, Sabourdin N, Veyckemans F, Babre F, Bourdaud N, Dahmani S, et al. Management of the child's airway under anaesthesia: the French guidelines. *Anaesth Crit Care Pain Med* 2019.
- [8] Habre W, Disma N, Virag K, Becke K, Hansen TG, Jöhr M, et al. Incidence of severe critical events in paediatric anaesthesia (APRICOT): a prospective multicentre observational study in 261 hospitals in Europe. *Lancet Respir Med* 2017;5(5):412–25.
- [9] Dahmani S, Laffargue A, Dadure C, Veyckemans F, French APRICOT trial group. Description of practices and complications in the French centres that participated to APRICOT: a secondary analysis. *Anaesth Crit Care Pain Med* 2019.
- [10] McCann ME, Lee JK, Inder T. Beyond anesthesia toxicity: anesthetic considerations to lessen the risk of neonatal neurological injury. *Anesth Analg* 2019;129(5):1354–64.
- [11] Vickers MD. Anaesthetic team and the role of nurses—European perspective. *Best Pract Res Clin Anaesthesiol* 2002;16(3):409–21.
- [12] Dony P, Seidel L, Pirson M, Forget P. Anaesthesia care team improves outcomes in surgical patients compared with solo anaesthesiologist: an observational study. *Eur J Anaesthesiol* 2019;36(1):64–9.
- [13] Zgleszewski SE, Graham DA, Hickey PR, Brustowicz RM, Odegard KC, Koka R, et al. Anaesthesiologist- and system-related risk factors for risk-adjusted pediatric anaesthesia-related cardiac arrest. *Anesth Analg* 2016;122(2):482–9.

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