In Reply:

We thank Xue *et al*. and Shetty *et al*. for the interesting letters they sent in response to our recent article.[1] We fully agree with the first remark by Xue *et al*. We did not provide the method of anesthesia induction used in our protocol. However, we thought our method was clear enough to prevent any doubt regarding the technique of induction. All the adult patients received intravenous boluses of appropriate dosage of opioids and hypnotic agents (in most cases sufentanil and propofol, respectively). In our country, inhalation-induction of anesthesia is not popular in adults. Moreover, all the patients received neuromuscular blocking agents. We deliberately standardized anesthesia procedure to prevent poor anesthesia quality affecting airway management quality. Facemask ventilation (FMV) was attempted only if anesthesia depth and apneic status were confirmed both clinically and instrumentally. We are confident that Xue *et al.* are fully aware of the methods we have used. Attempting FMV in a nonapneic patient would have been considered as a fault in our standards. In operating room settings, there are very few if any indications for FMV in nonapneic elective patients requiring tracheal intubation. Mechanically-assisted noninvasive facemask spontaneous ventilation has been used in some morbidly obese patients but only while awake. These patients were returned to mechanically noninvasive, fully controlled ventilation as soon as spontaneous ventilation ceased. Moreover, we believe that maintaining spontaneous ventilation at induction may correlate with poor anesthesia quality associated with maintained airway protective reflex that was shown to increase the difficulty of conventional airway management maneuvers. Because these reflexes are resistant to deepening of anesthesia,[2] defense and protective reflex may persist after loss of spontaneous ventilation if muscle relaxants are not administered.[3] These observations are strong arguments for managing the airway of patients showing difficult airway predictors in the best optimal conditions while deeply paralyzed. We had demonstrated a few years ago that standardization of anesthesia quality, mainly by paralyzing the patients with succinylcholine, improved the success rate of tracheal intubation performed by physicians in difficult prehospital tracheal intubation conditions.[4] Very recently, we also showed that this strategy, combined with a difficult airway management algorithm observance, allowed all the patients' airways to be quickly secured in prehospital settings.[5] Similarly, we did not describe all the components determining optimal conditions for FMV. Once more, we thought it was obvious that patients were placed in optimal conditions for FMV because only senior participants managed patients showing difficult airway predictors. We instead focus on the capability of all participants using the same FMV difficulty grading system, which includes the need for oral airway (and all optimizing maneuvers), to standardize airway management procedure regarding neuromuscular administration strategy. By using this strategy, we were confident that all FMV difficulty grades were recorded in patients placed in best-optimal condition for FMV. This is also true for the Cormack and Lehane (CL) laryngoscopy grading system. It is implicit that the CL cannot be scored if direct laryngoscopy is performed by a trainee, if the patient'shead is not properly placed, if external laryngeal maneuvers are not correctly performed, and so on. Then, we omitted providing some data, probably because of the high quality of the standards we imposed upon ourselves.

The second remark deserves a discussion. We agree with Xue *et al.* that adequate oxygenation should be the exclusive core goal for all anesthesiologists during airway management. This was our main concern when we built this algorithm: maintaining oxygenation during airway management. We are aware that the decision to administer muscle relaxant in patients with potentially difficult airway is disputable. We decided on injecting succinylcholine at induction of anesthesia either primarily in potentially difficult airway patients or secondarily in grade III–IV difficult FMV, because we previously validated rescue airway tools and plans[6–16] that are proposed in the algorithm. Our results combined with our daily clinical practice (the algorithm is still ongoing in our department) confirm that this option (not opinion) is valuable and safe for the type of patients we are managing. We have excluded from the algorithm patients suspected or treated for ear, nose, and throat tumor. Moreover, emergency and obstetric cases use a specific algorithm. We attest that succinylcholine injection never worsened but rather systematically improved FMV quality at induction of anesthesia, suggesting that muscle paralysis is important not only for simplifying tracheal intubation maneuvers but also for improving FMV quality. Almost all "postinduction" patients with grade III difficult FMV improved after succinylcholine reinforcing the strength of our strategy. Moreover, primary succinylcholine administration in case of three or more predictors certainly placed the patients in optimal-best conditions for FMV. We think that the unique pharmacology of succinylcholine promoted such results. The only patient with grade IV difficult FMV we encountered during the trial had received primary succinylcholine. In this patient FMV was difficult because of many reasons, including a narrow and collapsible airway, but also because of the thick beard the patient was wearing. This beard prevented facemask seal, resulting in poor ventilation generation. A second case has occurred very recently in our department. A 58-yr-old woman admitted for elective cholecystectomy demonstrating two predictors (body mass index = 38 kg/m^2) received secondary succinylcholine because of grade IV difficult FMV. One min after injection the grade of difficult FMV was III. Because of optimal preoxygenation, arterial oxygen saturation (Sa_{O_2}) nadir was 89%. Her trachea was intubated with a gum elastic bougie (GEB) over which the tube was railroaded under direct laryngoscopy (CL = IIb). We understand the concerns of Xue *et al.*, but attempting immediate laryngoscopy in a patient withf difficult FMV before admin-

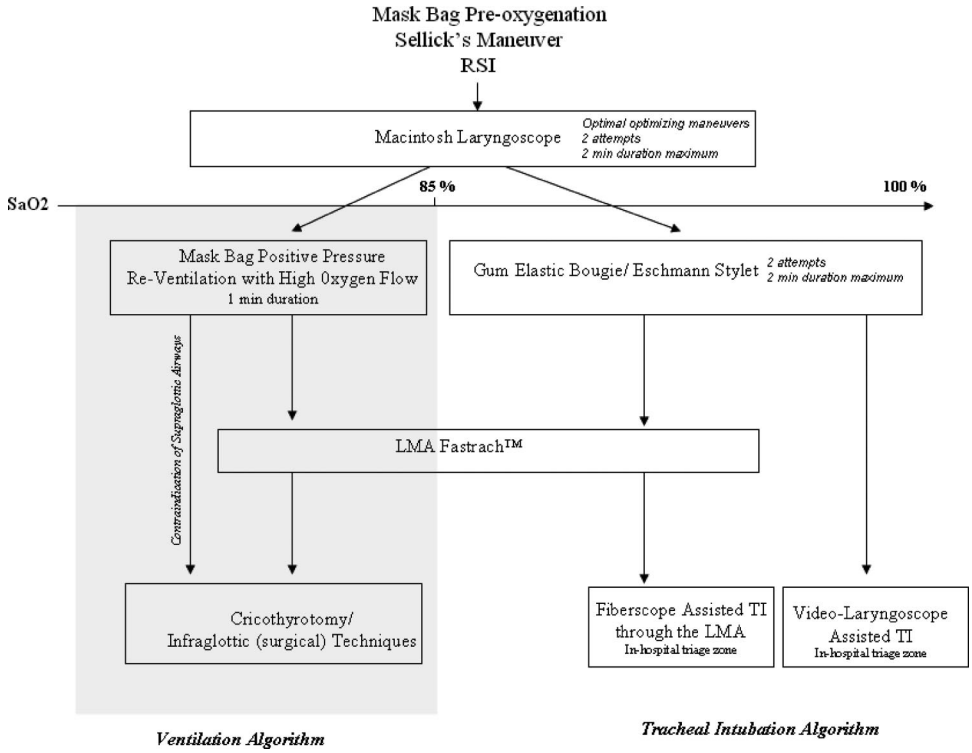

Fig. 1. Difficult airway management algorithm. LMA Fastrach™ (SEBAC, Pantin, France); RSI = rapid sequence induction; TI = tracheal intubation. Used with permission from Sudrial J, Birlouez C, Guillerm A-L, Sebbah J-L, Amathieu R, Dhonneur G: Difficult airway management algorithm in emergency medicine: Do not struggle against the patient, just skip to next step. Emergency Medicine International 2010; 826231.

istering a muscle relaxant cannot be a standard in our settings. We believe that this approach, which was discussed in our country 20 yr ago, usually before administrating long-term pancuronium, is no longer performed. Indeed, very efficient pharyngeal, periglottic ventilation tools are available to allow ventilation even in morbidly obese patients. Thus, we believe that there is a need to evaluate for "the chance of achieving successful" orotracheal intubation before injection of succinylcholine. Moreover, our algorithm proposes a very efficient solution for viewed tracheal intubation to be used in paralyzed patients (succinylcholine or rocuronium with sugammadex, correctly dosed, ready for use). The "cannot intubate cannot ventilate" scenario was activated only once in the current study and wassolved simply by using the first step alternative device (LMA CTrach®; SEBAC, Pantin, France). Finally, we are as confident as the prehospital emergency medicine physician managing patients with difficult airway and poor oxygenation storage that primary succinylcholine improves airway management quality.

The third comment from Xue *et al.* concerns our failure to report intubation in all patients and apnea time in patients with difficult airway. These data are missing from our reports. However, recording intubation time and apnea time in the large number of patients we included was technically unrealistic. Although we do not fully agree with the computed model-based calculations of SaO_2 drop rate applied to clinical reality, we confirm that some morbidly obese patients with difficult aireay required more than 3 min for the completion of orotracheal intubation maneuvers. Indeed, the computed model does not take into account the reventilation actions we are doing in the event that SaO_2 concentration drops less than 90%. We have implemented our algorithm with new optical devices based on their efficiency at maintaining optimal SaO_2 during difficult airway management.[16] Rather than time measurement, we focused on oxygenation quality recordings. For many years, we have settled oxygenation quality standards that are applied in clinical practice. Our standards depend on the situation: emergency medicine/operating room anesthesia situations. In the operating room, we recommend activating the ventilation arm of the algorithm if SaO_2 concentration drops less than or cannot be maintained at more than 90%. In emergency situations, the inferior limit of SaO_2 is settled at 85%. Moreover, we have defined time limits for all maneuvers, also depending on the clinical situation. Because of the efficiency of our alternative methods, we have decided to define failure for each airway management tool (usually two failed attempts), but also theoretically limited the time duration for the maneuvers. We have settled a time limit of "2-min job" for each step of the algorithm in case of operating room situations, and "1-min job" for the emergency cases, including the obstetric cases.[12] Figure 1 illustrates our previously published prehospital emergency medicine algorithm. Moreover, we apply the following rule during difficult airway

management: "Do not struggle against the patients, just skip to the next step of the difficult airway management algorithm."[17] Because of these standards, we did not measure intubation or apnea times. We thank Xue et al. for their pertinent propositions, some of them being currently applied for several years.

We have responded to three issues of Shetty *et al.* in our response to Xue *et al.* We have precisely defined exclusion/inclusion criteria including fiberoptic tracheal intubation indications in the methods section of our trial. There is no upper limit in the number of predictors to exclude the patient or to propose fiberoptically tracheal intubation.

The fourth issue from Shetty *et al.* deserves short explanations. The CL in the three patients intubated with the combination of the Airtraq® (Vygon, Ecouen, France) and GEB cannot be scored properly. In these patients the glottis was visible (CL = 1) but the larynx was sitting laterally far from the distal tip of the blade, and a long and narrow partially floppy epiglottis misdirected systematically the endotracheal tube into the pyriform fossae. We had observed that in two circumstances GEB dramatically shortened and simplified tracheal intubation with the Airtraq™ laryngoscope: in the presence of an abnormally distant larynx, the Sellick maneuver is applied. Then in these cases we use GEB to shorten tracheal intubation with the Airtraq™ laryngoscope. We have recorded videos of such maneuvers we could send to Shetty *et al.*

During this maneuver the Airtraq™ position is stabilized in optimal best position,[15] the endotracheal tube is rearmed in the channel (but not pushed) toward the glottis. GEB is passed through the endotracheal tube armed in the channel. Then manipulations of the distal tip of GEB in combination with soft changes in Airtraq™ position permits tracheal access and endotracheal tube railroading. We agree with Shetty *et al.* that we should have described this maneuver more extensively. We are ready to publish a case series demonstrating the value of GEB in case of difficult Airtraq™ intubation.

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Difficult Tracheal Intubation of In-hospital Emergent Patients

To the Editor:

In their recent article concerning airway outcomes and complications of in-hospital emergent tracheal intubations at a university hospital, Martin *et al.*[1] reported a difficult tracheal intuba-

This letter was sent to the author of the above-mentioned article. The author felt that a reply was not necessary.—James C. Eisenach, M.D., Editor-in-Chief