errors in the health profession. It recommended adaptation of the aviation model of crew resource management, which was called CRM in medicine. By definition, it is the promotion of safety by addressing behavioral and cognitive skills needed to effectively manage all health resources, especially in a crisis situation through team training. The key components of CRM for building team effectiveness are:

1. Team leadership,
2. Mutual performance monitoring,
3. Backup behavior,
4. Adaptability, and
5. Team orientation.

This principle is especially effective when applied to high acuity situations like in the intensive care units, operating rooms and emergency departments. However, there is presently no evidence to state that CRM results in effective team building. But, it is still believed to help in developing medical institutes as high reliability organization. Pioneering work in anesthesia was done by Gaba et al. in the development of anaesthesia CRM.[6] This is a simulation based training which focuses on team effectiveness in managing critical high-risk situation, video taping them and debriefing the performers to achieve optimum output. It has helped in the recognition of abnormal situations; effectively perform what needs to be done as a team by training systematically on simulators to effectively perform leadership, team work, communication and resource management. Several programs have followed the success of ACRM and currently obstetrics, pediatrics, surgery and emergency medicine have their own high-risk simulation program based on this model.

To conclude, simulation can create realistic situations and exposes several shortcomings in human behavior and skills, which cannot be assessed by traditional methods. Hence the future direction in assessment would be to integrate classroom training with multidisciplinary skill and behavior assessment on a simulation based platform. Nontechnical skills and CRM is key in the development of high reliability medical organization.

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Inadvertent pneumothorax caused by intubating bougie

To the Editor,

Bougie is a frequently used airway adjuvant in Cormack-Lehane 2b/3a. It is also used as an alternative to airway exchange catheter to change endotracheal tube (ETT). We report here a bougie related pneumothorax and various methods to prevent bougie induced serious airway injuries.

A 44-year-old male weighing 86 kg with thyroid swelling for 8 years was scheduled for hemithyroidectomy. Preanesthetic examination revealed short neck, prominent upper incisors and modified Mallampati grade 3. There were no features of difficult mask ventilation. After preoxygenation, anesthesia was induced with fentanyl 150 mcg and propofol 120 mg. There was no difficulty in mask ventilation and suxamethonium 100 mg was administered. The direct laryngoscopic view was CL 2b. Single use bougie-VBM Medizintechnik GmbH-Germany [Figure 1] was used to railroad 8.5 mm ETT. Pilot balloon of ETT could not be inflated as the cuff was damaged by the prominent upper incisors. Endotracheal tube was exchanged over the bougie. There was accidental distal migration of bougie as the patient bucked during rail roading. After intubation there was decreased air entry on
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the right side and the saturation dropped to 96%. After excluding endobronchial intubation, two possibilities were considered—either a blood clot causing right lung collapse or a pneumothorax. Flexible fiberoptic bronchoscopy done through the ETT revealed a mucosal tear in right main bronchus. A few minutes after bronchoscopic examination, systolic blood pressure dropped to 100 mmHg, airway pressure increased to 30 cm H₂O and right side percussion turned into a hyper resonant note. Chest X-ray done on the operation table confirmed the clinical diagnosis of right-sided tension pneumothorax. A 28 F intercostal drain was inserted in the right fourth intercostal space. Patient was shifted to Intensive Care Unit, where he eventually made an uneventful recovery.

Bougies can be a classic gum elastic bougie or the newer single use bougies. The classic Eschmann bougie is made of braided polyester covered with resin. In contrast, the newer bougies are made of plastic, are more rigid and are either solid or hollow tubes. The distal end is not blunt as in gum elastic bougie but is a sharp circular opening to facilitate ventilation and confirm tracheal placement by EtCO₂. Possible causes for airway trauma in our case were rigidity of the plastic bougie and inadvertent distal migration of the bougie during railroading of ETT. Majority of bougie related trauma were associated with single use plastic bougies as they are more rigid[1] and their distal end exerts more pressure on the tracheal wall.[2] Airway trauma can be reduced by advancing bougie under vision and following the markings as a guide to decide the depth of insertion. In case it is inserted too deep, withdraw few centimetres before railroading the tube.[3] Water based jelly should be used to facilitate smooth movement of the tube over the bougie. During railroading, the proximal end of the bougie should be stabilized by an assistant to prevent distal movement along with ETT. Finally we would like to emphasize the importance of adequate depth of anaesthesia during repeated airway manipulations.

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Figure 1: Bougie used in this case (a) compared with gum elastic bougie (b)