

## A schematic guideline of tracheal intubation in patients with extensive burns in the posthealing period

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### Introduction

The number of plastic or reconstructive surgical operations in the posthealing period of extensively burned patients is increasing as a result of decreased mortality. While the patients are physiologically stable at this stage, most anesthetic problems are due to technical difficulties associated with scarring of the body surface. Difficulty in tracheal intubation can be expected when a patient presents with severely contracted oral commissure and/or restriction of neck movement. A variety of maneuvers in the management of difficult intubation may be applicable; however, there are few practical guidelines for their choice in this patient population. It is important to establish and follow guidelines to avoid prolonged attempts and a delay of surgery. After a few years of clinical trials, we devised a schematic guideline of intubation procedure in this patient population. The results of the recent 24 months of clinical experience of the application of this guideline are reviewed.

### Patients and methods

From the beginning of January 1990 to the end of December 1991, a total of 79 tracheal intubations in extensively burned patients with scar contracture of the face and neck were performed using our guideline. Thirty-four patients (22 men, 12 women), who had surgical plastic reconstructions under endotracheal anesthesia, were included. Their ages ranged from 17 to 74 years (mean 38 years), weights from 28 to 78 kg (mean 58 kg),

and heights from 100 to 183 cm (mean 160 cm). The minimum weight and height were small due to inclusion of a patient who had undergone bilateral leg amputation. Early surgical excision and immediate grafting after injury during emergency care were excluded, and no patients had respiratory or circulatory complications at the time of operation.

### *The schematic guideline of tracheal intubation procedure in the patients with burned scar contracture of the face and neck*

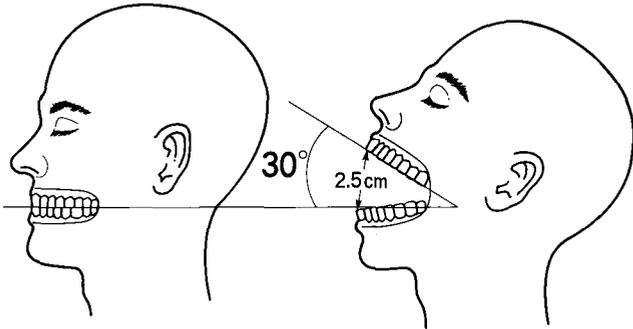
Assessment of restricted movement in opening of the mouth and extension of the neck must be made preoperatively. The estimate is made either by the distance between the upper and the lower incisors at full opening of the mouth, or by the angle traversed by the occlusal surface of the upper teeth when the head is extended from the neutral position (Fig. 1). When mouth opening is over 2.5 cm and neck extension is over 30°, the patient is considered to have no restriction.

Tracheal intubation is attempted in the following order (Fig. 2).

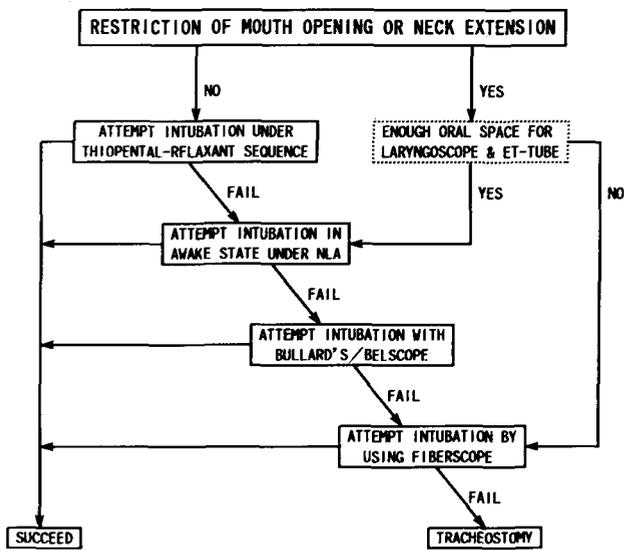
1. When no restriction is present, apply the ordinary method, i.e., thiopental-relaxant sequence by using a Macintosh laryngoscope.
2. When any restriction is present or the above method fails, attempt intubation in the awake state under neuroleptanalgesia (NLA).
3. When the above maneuver fails, utilize a special laryngoscope such as a Bullard laryngoscope [1] or a Belscope [2].
4. When unsuccessful or when a patient presents with insufficient oral space for the insertion of a laryngoscope and an endotracheal tube, utilize a fiberoptic laryngoscope.
5. When all above maneuvers fail, employ tracheostomy.

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**Fig. 1.** Estimates of mouth opening and neck extension. Patients are assessed as “without restriction” when both mouth opening >2.5 cm and neck extension >30°



**Fig. 2.** An algorithm of tracheal intubation procedure in patients with burned scar contracture of the face and neck. *NLA*, neuroleptanalgesia; *ET*, endotracheal

**Results**

In the preoperative assessment, 36 patients (45.6%) were found to have no restriction of mouth opening or neck extension, and 43 patients (54.4%) had restriction of either or both.

**Table 1.** Results of 79 intubation procedures

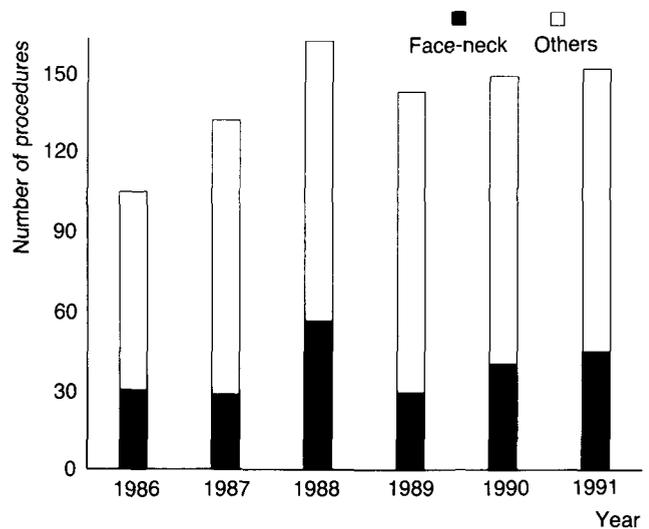
Intubation procedure	No. of Cases
Under thiopental-relaxant	36 (45.6%)
In awake state under NLA	19 (24.1%)
Use of Bullard or Belscope	18 (22.8%)
Use of fiberscope	5 (6.3%)
Tracheostomy	1 (1.3%)
Total	79 (100%)

NLA, neuroleptanalgesia

The final results of 79 intubations are summarized in Table 1. All 36 patients with no restriction were successfully intubated by the ordinary method. The remaining 43 patients, including 1 patient who did not have enough oral space for laryngoscope insertion, were intubated in the awake state under NLA. Intubation of 19 patients (24.1%) whose larynxes were visible by an ordinary laryngoscope was successful. Laryngoscopy using either a Bullard laryngoscope or a Belscope blade was applied in 23 patients in whom a Macintosh laryngoscope failed to display the larynx. Of these, 18 patients (22.8%) were successfully intubated. In five patients (6.3%), intubation was successful using a fiberoptic method; in four of these five, attempts using the previous method had failed, and one had insufficient oral space. There was one case in which all of the above intubation procedures failed, and an emergency tracheostomy was performed.

**Discussion**

An extensive burn is usually defined as a second- or third-degree burn involving more than one-third of the body surface [3]. These patients require multiple surgical plastic reconstructions of scar contracture in the posthealing period after successful early life-support treatments. Annually, the face and neck burns amounted to 20% to 35% of all extensive burns requiring plastic surgery in our hospital (Fig. 3). In 1988, when the number of such operations markedly increased, we established a tentative guideline for intubation procedures in this patient population [4]. After 1 year of



**Fig. 3.** The annual number of surgical plastic reconstruction of scar contracture in the posthealing period of extensive burns in Nippon Medical School Hospital. *Closed bars* represent cases with burn injury including the face and neck

clinical use, we revised the guideline to the more detailed and practical version shown in Fig. 2. When a patient presents with severely contracted oral commissure and neck movement that might preclude tracheal intubation, it is important to choose the most suitable intubation method. Prolonged attempts at intubation delay surgery and can create potentially life-threatening situations [5]. In the selection of the most suitable method, it is quite useful to have an algorithm such as the one shown here. Since the guideline was applied, all operations except for tracheostomy were started within 35 min of the first attempt at intubation without any difficulty.

The 24-month period in which the guideline was used showed that our preoperative assessment was correct and reliable for the prediction whether the ordinary method could be safely conducted or not. Intubation proved to be straightforward in all patients who met the criteria shown in Fig. 1 after a thiopental-relaxant sequence. The preoperative assessment is quite simple and practical. Two and half centimeters of the mouth opening and 30 degrees of neck extension can be measured by using a ruler and a protractor.

Although a variety of techniques and maneuvers other than those listed in our guideline have been introduced for the management of difficult intubation [6–8], we excluded some methods which were rarely applied to this patient population. The retrograde method and blind nasotracheal attempt were included in our tentative guideline; however, both methods were not successful. Scarring of the neck and the nostrils, and the difficulty in moving the neck precluded these methods. Incision of soft tissue to release contracture under local anesthesia [9] is also impractical because scarring is usually quite complicated in extensive burns. Even a simple incision sometimes results in unexpected massive bleeding.

Scar contracture of the face and neck was not the only factor for the increasing difficulty in intubation in this patient population. Most patients (33 of 34) had undergone multiple plastic reconstruction surgery since their initial grafting. Scarring was changing significantly at times, and the previous anesthetic record was not al-

ways helpful for the present intubation attempt. Each patient must be assessed separately on each occasion. Moreover, the awake intubation attempts were needed in more than half (54.4%) of the cases. Although it was quite difficult to gain full cooperation from each patient because of his or her psychological condition, a conscious patient must be informed of the intubation procedure. About 60% of the patients (20 of 34) had some degree of mental disorder: 11 had attempted suicide by self-inflicted burns, and 9 had developed mental problems during their hospital stay. The doses of neuroleptic or analgesic drugs should be carefully titrated in these patients because many were taking multiple psychotropic drugs concomitantly.

In summary, we introduced our guideline for tracheal intubation in extensively burned patients with scar contracture of the face and neck, and the results of the recent 24 months of the application of this guideline were presented.

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