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An Epidemic of Pseudomembranous Laryngotracheitis

K. G. Belani, M.B., B.S.,* and J. Priedkalns, M.D.†

A serious complication of endotracheal intubation is pseudomembranous laryngotracheitis. At our institution there was a sudden increase in the number of cases in December 1975. For the 12 months preceding December 1975, 8,999 anesthesias were administered, and one case of pseudomembranous laryngotracheitis occurred. In December 1975, 677 patients were anesthetized, and the complication developed in six over a period of ten days.

An epidemiologic study was initiated in an attempt to identify the cause. The characteristics of the disease and patients were noted. The pseudomembranes and laryngeal swabs were examined histologically and cultured. The endotracheal tube cleansing system was investigated. After evaluating the results, tissue injury by glutaraldehyde (Cidex®) was suspected, and disposable endotracheal tubes were introduced. As the exact agent was still unidentified, endotracheal tubes handled in the original manner were reintroduced. Early recurrence of the complication in a single patient led to permanent use of disposable endotracheal tubes.

Results

Four of the seven patients involved were women, 28 to 80 years old. Three patients were ASA I and four were ASA II. Aside from the surgical conditions, all patients had no major, complicating medical problem. No patient had a history of laryngotracheal disease, allergy, or drug atopy. Six patients had had uneventful tracheal intubation in the past. Two patients were operated upon for total hip arthroplasty, and the others underwent a variety of procedures. Three patients were supine, two lateral, and one each in the nephrectomy and lithotomy positions. There was no bucking or straining during the procedures, and no clear unifying factor was identified in the patients.

All the patients received general anesthesia, and the anesthesiologists for all patients were different. Experienced anesthesia aides cleaned the anesthesia equipment, and there had been no change in cleansing methods. Three different anesthesia machines were used. The anesthetic agents used were thiopental, pancuronium, fentanyl, and N_2O in six cases, and thiopental, pancuronium, halothane, and N_2O in one. All tracheas were intubated with a cuffed Portex endotracheal tube bearing a Knight-Grimm-Sanders[1,2] latex cuff. Three patients required two attempts at tracheal intubation; extubation in each case was accomplished without difficulty. All endotracheal tubes were lubricated with cyclomethycaine sulfate jelly (Surfacaine®). Intubation times ranged from 1.5 hours to 9.3 hours (mean 4.3 hours). Following extubation, all patients developed symptoms in one-half to 48 hours (hoarseness, three patients; sore throat, three patients; dyspnea, one patient). Upper airway obstruction was present in all, necessitating tracheostomy in four. Six patients recovered fully. One other patient, who did not need tracheostomy, has residual hoarseness 14 months after intubation. Laryngoscopic examination at the onset of symptoms showed an edematous and congested larynx in every patient. A visible membrane was present in six patients. Histopathologically, this consisted of a mucinous matrix containing abundant neutrophils and necrotic debris. Gram staining did not reveal any bacteria, and special stains were negative for fungal organisms. Normal flora were cultured from laryngotracheal swabs, and no fungal growth occurred.

The cuffed endotracheal tubes and other anesthesia equipment were decontaminated by the Cidematic-A® process.‡ This process lasted 85 minutes and consisted of a wash cycle with detergent solution, four primary rinse cycles, a spin-dry cycle, a disinfecting cycle in 2 per cent activated aqueous alkaline glutaraldehyde, four secondary rinse cycles, and a final spin-dry cycle. After the complication developed in the first six patients, two series of tests were carried out in our hospital toxicology laboratory to detect the presence of glutaraldehyde in the secondary rinse water specimens and in the decontaminated endotracheal tubes. All the first and some of the second rinsings, but no others, showed the presence of glutaraldehyde.

* Fellow.
† Assistant Professor.
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Address reprint requests to Dr. Belani.

‡ Arbrook, Inc., Arlington, Texas.

Four cleaned cuffed endotracheal tubes, similar to those used in patients in whom the complication developed, were selected at random. They were eluted in saline solution at room temperature for either 12 hours or one week. No glutaraldehyde was found in the saline eluent.

While these tests were done, the latex cuffed Portex tubes were replaced with disposable Hi-Lo® tubes.§ The epidemic stopped abruptly. When the complication recurred on reintroduction of the endotracheal tubes, two more cleaned tubes were selected at random and sent to the laboratories of Arbrook, Inc., Arlington, Texas. These were eluted in distilled water. The eluent was negative for glutaraldehyde. Next, the cuff was filled with water and the rinse water from inside the cuff was tested for glutaraldehyde. Glutaraldehyde in trace amounts was found. The cuffs did not leak air.

Discussion

Pseudomembranous laryngotracheitis has been known to occur sporadically,[3–5] but epidemic occurrence has not been reported, although Hamilton[6] observed epidemic post-intubation upper-airway obstruction in two groups of patients.

The analysis of our epidemic did not suggest obvious host factors as being involved. Of the environmental factors, only the Knight-Grimm-Sanders latex cuffed Portex endotracheal tubes were common to all patients. This, together with the nature of the lesion, suggested that the endotracheal tubes were the source of the problem. Discovery of glutaraldehyde inside the cuffs revealed a possible etiologic factor. Chemical irritation from the area of the cuff is consistent with our pathologic findings, and no case of pseudomembranous laryngotracheitis had occurred with uncuffed Portex endotracheal tubes. Cleansing of the tubes with the removable cuffs in place would leave the space between cuff and tube as a potential place for glutaraldehyde accumulation. During cleansing, glutaraldehyde may have diffused into this space or entered the cuff through uncapped air injection sites.

Glutaraldehyde has been shown to be severely irritating to conjunctivae of albino rats,[7] though surprisingly, in the same report, endotracheal tubes dipped in 2 per cent glutaraldehyde and only drained were not followed by laryngeal damage after intubation of dogs.

Stetson and Guess[8] reviewed the possible hazardous substances found in endotracheal tube materials and toxic changes that may occur following repeated use and cleansing of tubes. Since the Knight-Grimm-Sanders cuff has been used at our institution with few problems since 1943, the cuff material itself was not as likely a cause of the outbreak as the toxic material found within the tested cuffs.

The failure by us or Arbrook to elute any glutaraldehyde from the cuffs does, however, leave the final mechanism of laryngeal injury somewhat speculative, and it may be that under the conditions of actual use with the latex cuff at body temperature and stretched after inflation diffusion out could occur. Repeated use of tubes may have resulted in development in the cuffs of minute flaws that could release glutaraldehyde, although frank cuff air leakage was not found in any case. The previous sporadic occurrence of the same complication indicates that the conditions necessary for laryngeal injury may have been present for some time. The sudden increase in occurrence at this time remains unexplained.

In summary, an epidemic of serious laryngeal injury associated with endotracheal intubation occurred in our operating rooms. A suspicious toxic agent was isolated. With this presumptive etiology, we introduced single-use disposable endotracheal tubes in our suite. There has been no case of pseudomembranous laryngotracheitis since that time.

§ National Catheter Corp., Argyle, New York.

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