A devastating outcome after adenoidectomy and tonsillectomy: Ideas for improved prevention and management

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OBJECTIVE: To develop strategies that may assist the surgeon to prevent and manage severe bleeding complications after adenoidectomy and tonsillectomy.

STUDY DESIGN: Retrospective.

SUBJECTS AND METHODS: Expert reports for malpractice lawsuits or professional boards were reviewed. The review was restricted to “deaths” and “permanent generalized neurological deficiencies.”

RESULTS: Forty-three cases matched our search criteria, including 32 deaths. Adenoidectomy cases (2) were associated with immediate bleeding because of direct vascular injury resulting in one death. Tonsillectomy cases were associated with delayed and repeated episodes of bleeding resulting in 31 deaths, including 19 children. Autopsy verified predominantly aspiration and vascular injuries. An apallic syndrome prevailed in surviving patients.

CONCLUSION: Careful inspection of the nasopharynx immediately before adenoidectomy and curettage in a piecemeal fashion under visual control is helpful to prevent direct injury to aberrant arteries. Tonsillectomy cases are associated with delayed and episodic bleeding with spontaneous cessation and young age. Inpatient observation should be strongly considered in cases with repeated bleeding episodes to provide immediate treatment. The follow-up should be focused on disturbed wound healing. Outcome appears to be dependant on adequate airway management. Rigid instruments and tracheotomy in case of intubation failure are highly recommended to facilitate airway protection and ventilation.

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PATIENTS AND METHODS

Institutional review board approval was provided. Data from expert reports written between 1980 and 2008 by at least one of the authors for malpractice lawsuits or on request by professional boards in relation to tonsillectomy and adenoidectomy were reviewed. The charts were available from the different offices of the experts. Only cases with lethal outcome or permanent generalized neurologic deficiencies were included in further analysis. As previously stated, data from earlier studies with a different topic...
(clinical features and risk factors) were partly reassessed for the subject of this study because of the rare incidence. Expert reports with other issues or from other authors were excluded. The search was not restricted by affiliations. Ideas of possible improvements in prevention and management in each individual case were discussed in the group of authors.

RESULTS

One hundred twenty-eight charts were related to “adenoidectomy” and “tonsillectomy,” but only 43 cases matched the search criteria “death” (32) and “permanent generalized neurologic deficiencies” (11). Two children (5 and 6 years of age) had undergone adenoidectomy, and 41 patients had undergone tonsillectomy (3-71 years of age; 23 children, 3 adolescents, and 15 adults) including one pediatric case with laser-assisted tonsillotomy. Twenty-one patients were female (49%). Bleeding never resulted from comorbidities or previously undetected coagulation abnormalities.

Adenoidectomy Cases

Among the adenoidectomy cases, there was one 5-year-old girl who died 2 days after surgery because of a 5-mm injury to an aberrant internal carotid artery (ICA). Immediately after curettage, an excessive bleeding had required packing of the nasopharynx and blood transfusions. After removal of the packing, the bleeding recurred and was managed by placing a suture below the level of the Eustachian tube orifice and packing of the nasopharynx. Arteriography revealed a normal finding. When bleeding recurred, revision surgery was indicated revealing a parapharyngeal wound with the pulsating artery. Thirty seconds later, an excessive bleeding started. The artery was exposed via the transcervical open approach. Because clamping could not stop the bleeding, the artery was stented. The vascular lesion was identified and closed with a vein graft. The girl presented with a brainstem syndrome and a thrombotic occlusion of the artery the following day that persisted even after an attempt of surgical removal. The girl had received 10 blood transfusions and died because of excessive intracranial pressure. Autopsy identified a severe brain damage and the vascular lesion. Unfortunately, the neck specimen below the skull base was incomplete, but virtual reconstruction of the specimen was highly suspicious for a curving of the ICA supported by the finding of an unusual proximity of the ICA to the mucosa. In the second adenoidectomy case, remnants of adenoid tissue in the midline had been removed uneventfully with a curette in a 6-year-old girl. Adenoid tissue surrounding the Eustachian orifice was removed with a conchotome, which was followed immediately by brisk bleeding. Management included packing of the pharynx and open transcervical approach with ligation of the injured aberrant ICA. CT scans identified an ipsilateral brain infarction in the territory supplied by the middle cerebral artery. Immediately after surgery, the girl presented with a contralateral hemiplegia that resolved partly within 3 weeks. Two years after surgery, motor deficiencies in the leg and arm as well as speech impairment were still present.

Tonsillectomy Fatality Cases

The subgroup of 31 lethal tonsillectomy cases comprised 19 children, 2 adolescents, and 10 adults. Primary bleeding did occur in one single patient (3%), secondary bleeding was registered 1 to 55 days after surgery (mean: 8.8; median: 6 days; Fig 1). Nineteen patients (61%) had experienced 2 to 7 bleeding episodes with spontaneous cessation (mean: 3.8; median: 3). Cardiopulmonary resuscitation had been performed at home (15) or in the hospital (13) after brisk bleeding had occurred. A ligature of greater arteries in the neck was performed in three inpatients who did not undergo resuscitation. Autopsy was undertaken in 15 patients (48%) and identified deep wound necrosis (3), hypoxic brain damage (5), aspiration (9), injury of the facial (3) or descending...

Figure 1  Post-tonsillectomy hemorrhage as single (15) or repeated (26) event. In patients with repeated bleeding episodes, the last day of a bleeding was registered for calculation.
palatine (2) or lingual (3) or branches of the external carotid artery (1), and arteritis dissecans of the internal carotid artery (1) or could not identify a specific lesion (1). Clinically, aspiration was verified in eight children (42%) and five adults (50%), wound necrosis in 10 children (52%), one adolescent (50%), and six adults (60%).

**Tonsillectomy Devastating Outcome Cases**

The subgroup with permanent neurologic sequelae included apallic syndrome (6), Horner’s syndrome (1), seizures and mental retardation (1), tetraplegia (1), or hemiplegia (1) and were reported for four children, one adolescent, and five adults after tonsillectomy. According to the surgeon’s statement, Horner’s syndrome most likely resulted from a deeply placed transoral suture ligation. All other deficiencies resulted from severe intubation suture problems, considerable aspiration, and time required for resuscitation. Immediate tracheotomy was performed in two patients to facilitate adequate airway ventilation. Primary bleeding did not occur in this subgroup; secondary bleeding was reported 1 to 14 days after tonsillectomy. Eight patients had experienced 2 to 7 bleeding episodes with spontaneous cessation (mean: 3.6; median: 3 bleeding episodes). Six patients had been in the hospital and underwent surgical revision (2), cardiopulmonary resuscitation (1), or both (3). After brisk bleeding had occurred at home in four patients, surgical revision with (2) or without (2) cardiopulmonary resuscitation was performed.

**DISCUSSION**

Adenoidectomy and tonsillectomy remain the most common surgical procedures performed worldwide, but devastating outcomes are inadequately addressed in the literature. To improve medical strategies and to avoid malpractice issues, such information is desirable, but even insurance companies and courts were unable to provide the authors with sufficient information. Therefore, a document review in the archives of the different expert offices appeared to be a way to improve our understanding of poor outcomes after these routine operations. We must accept that conclusions are limited because of the unknown number of procedures performed between 1980 and 2008 (time of our data collection). Moreover, it is unlikely that the authors received all inquiries by professional boards and courts from a 82-million people nation with approximately 150,000 tonsillectomy procedures per year. Therefore, our study does not suffice to calculate morbidity and mortality rates. However, the study revealed that secondary hemorrhage, episodic bleeding with spontaneous cessation, and a young age (<12 years) were hallmarks of such adverse events, and sex was not a risk factor.

The analysis of the adenoidectomy cases offered no suggestions for the management issue. Concerning prevention, we would suggest (1) careful inspection of the naso-pharynx, (2) curettage under direct vision to avoid curettage in a submucous plane, (3) avoidance of cutting forceps/conchotomes used to prevent unintentional vascular injuries, (4) removal of adenoid tissue in a piecemeal fashion rather than en bloc resection to avoid inadequate pressure on the adenotome, which may result in unintentional injuries to an aberrant artery running in a submucosal layer. All suggestions are made considering an aberrant course of the ICA. The artery may bulge medially in the coronary plane directly behind the posterior pharyngeal wall where it can be injured as reported in 1897 by Schmiegelow,13 for a 12-year-old boy who died after curettage. Although Weibel and Fields14 introduced a simplified classification of such abnormal courses of the ICA, Paulsen et al15 distinguished between a straight course, kinking, coiling, and curving of the ICA. Presumably, such a curving had existed in the 5-year-old girl with a lethal outcome after adenoidectomy. Because the neck specimen below the skull base was incomplete, it appears noteworthy to emphasize that a specific post mortem explanation technique should be respected.16 The course of the 6-year-old girl with permanent neurologic dysfunction resulting from excessive post-adenoidectomy hemorrhage (PAH) compares with a case reported by McKenzie and Woold17 who used an adenoid tag forceps in a 14-year-old boy for the removal of adenoid tissue just below the opening of the Eustachian tube, which resulted in violent arterial bleeding.

Analysis of the tonsillectomy cases addressed some issues concerning prevention, and the authors suggest a meticulous tonsil dissection to prevent unintentional vascular injury to vessels running close to the capsule (Fig 2). It should be noted that the heat of laser-assisted instruments or electronic devices may result in necrosis because of thermal damage. Unselected field electrocautery is dangerous because it results in a deeper and more extensive zone of necrosis and the exposure of more and larger vessels when sloughing of the eschar occurs. This presumably had caused the frequent number of wound necrosis in our cases. Because of an initial vascular spasm of the injured artery, bleeding may not occur in all cases immediately but instead with a delay. One should refrain from placing deep transoral sutures in cases with obvious wound necrosis because sutures may damage neurovascular structures as happened in the patient with permanent Horner’s syndrome. Moreover, injuries to the wall of greater arteries running close to the necrotic wound surface may result in pseudoaneurysm formation with delayed brisk bleeding (patients not included in this series), which is supported by reports in the literature.18 Suction of gastric contents before extubation presumably would have helped one of our patient with lethal bleeding on the day of surgery. Although Jones et al19 denied its usefulness for regular cases, we suggest this maneuver in every case of posttonsillectomy hemorrhage for a better assessment of blood loss and improved recovery. A close follow-up appears mandatory to identify signs of infection and wound necrosis as early as possible. Autopsy and clinical examination verified such lesions in a considerable
number of patients, and early antibiotic treatment could have been capable to stop the continuing process of wound necrosis resulting from bacterial superinfection.

Although not proven by the data of our case series, physical activity should be resumed when the wounds have healed completely. Adequate informed consent must be required to be prepared for malpractice claims. Inpatient observation had been recommended in three cases, but the patients/parents insisted on early dismissal from the hospital. All malpractice claims were discontinued before trial because of an undersigned informed consent. Written discharge instructions must be given to the patients/parents. Because of the delay of bleeding, 19 of 31 tonsillectomy patients were at home when brisk bleeding (re-) occurred. Therefore, clear and written instructions should be given to any tonsillectomy patient who is dismissed from the hospital including an address and telephone number of an emergency department with a skilled staff and adequate instruments available 24 hours in the living area of the patient. One 42-month-old boy in our case series died because the mother called a taxi when brisk bleeding reoccurred. The boy was transferred to a pediatric department where no surgical means were available. Therefore, professional transport to the department should be demanded and accompanied by a skilled emergency physician. Episodic bleeding with spontaneous cessation suggests inpatient observation to

Figure 2  Specimen of an 8-year-old girl showing a 3-mm lesion of the left lingual artery (arrow). (A) Overview and (B) detail.
provide optimal medical care at any time when brisk bleeding reoccurs. To limit the hospital stay to a reasonable extent, we calculated the time interval between the first and the last bleeding episode whenever bleeding repeatedly had occurred. According to our calculation, a stay for 4 days would cover 75%, certainly not all, bleeding episodes (Fig 3). Our recommendation contrasts sharply to statements of other authors who suggested only an overnight observation, but the data collections were limited by geographic factors and age, which was not the case in our study.20,21 However, our concept includes individual factors such as disturbed wound healing, reduced general condition, or psychological factors. Conversely, it is noteworthy to realize that inpatient observation does not eliminate the risk of lethal outcome because it had occurred in 16 patients. Brisk bleeding was so intense that all means of therapy failed, and eight patients did not even reach the operating room for further surgical therapy.

In case of frank bleeding, immediate installation of an intravenous line and determination of blood values and blood groups are basic procedures of management. Suggested refinements concerning the management protocol would include the use of rigid suction instruments. Our study revealed that death resulted in at least 13 cases from aspiration of blood with subsequent suffocation. Exposure of the larynx entrance was also considerably impaired in all 10 patients with permanent neurologic dysfunction by copious bleeding and coagula. Rigid instruments for suction and endoscopy would have been extremely helpful and should therefore be readily available at all times and everywhere. It is worthwhile to emphasize that intubation failures should be followed by immediate tracheotomy to achieve adequate airway protection and ventilation. This part of our suggested management protocol should be applied even more strictly to children because the smaller diameter of the upper airways is much easier to be blocked by blood and coagula within minutes. Arteriography as an adjunctive procedure should be included in selected cases with delayed hemorrhage to exclude aberrant courses of greater arteries or pseudoaneurysm formation as performed in one adenoidectomy and one tonsillectomy case. Although the findings could not identify a lesion in both cases, no superior technique exists to assess the vascular status in cases of episodic bleeding with spontaneous cessation, particularly if the wounds have healed completely. Ligature of the external carotid artery at an early stage should be performed. When local measures of treatment are ineffective and time-consuming, fixation of swabs (two patients) or packing of the pharynx (nine patients) appears ineffective. Individual ligation of the superior thyroid, lingual, facial, and ascending pharyngeal artery should be included as well as a meticulous dissection of the internal, external, and common carotid artery to exclude abnormal blood supply of the tonsil region deriving from these vessels as could be shown in three patients (not from this series). Transoral compression of the bleeding vessel should be performed. A clamped swab or an index finger had been useful in patients (not from this series) to stop bleeding by pressure on the vessel. This simple maneuver has been shown to be more effective than waiting for intubation and revision surgery because it immediately stops the bleeding, protects the airways, and contributes to visualize the entrance of the larynx.

CONCLUSION

Copious bleeding after adenoidectomy is extremely rare and likely to be caused by an injured aberrant artery and occurs immediately after curettage. Therefore, careful inspection of the nasopharynx should be performed before curettage. Surgery should be postponed if pulsations are visible and aberrant courses of greater arteries are excluded by arteriog-
raphy, preferably magnetic resonance angiography. The management of brisk bleeding includes packing of the nasopharynx and arteriography as well as mutilating surgical approaches in selected cases. Tonsillectomy cases occur more frequently secondary bleeding, episodic bleeding with spontaneous cessation three times on average, and a young age (<12 years) were identified as risk factors. Inpatient observation should be strongly considered in cases with repeated bleeding episodes to provide immediate treatment. Most fatalities are related to aspiration and airway-management problems. Therefore, rigid instruments for suction and bronchoscopy are indispensable.

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FINANCIAL DISCLOSURE

None.

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