

# Cervicofacial emphysema following Harmonic scalpel tonsillectomy: case report and comprehensive review of the literature

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## Abstract

**Background:** Tonsillectomy is one of the most common surgical procedures performed worldwide. There are a handful of common complications, with bleeding being the most feared; however, rarer complications can present to a wide range of medical professionals.

**Methods:** A 12-year-old girl presented with cervicofacial emphysema following tonsillectomy. This paper discusses the case and the management adopted, and presents the findings of a comprehensive literature review.

**Results:** The patient made a full recovery, and was discharged after 3 days following conservative management with intravenous broad-spectrum antibiotics and supplemental low-flow oxygen.

**Conclusion:** This paper presents the first reported case of cervicofacial emphysema following Harmonic scalpel tonsillectomy. Although this is an exceptionally rare complication, it is potentially serious and warrants further description to improve awareness.

**Key words:** Tonsillectomy; Complications; Emphysema

## Introduction

The surgical procedure of tonsillectomy has been performed historically since at least the time of Christ.<sup>1</sup> It is, to this day, consistently one of the most common operations performed by ENT surgeons worldwide. The indications for surgery include recurrent tonsillitis, recurrent peritonsillar abscess, and sleep-disordered breathing or obstructive sleep apnoea syndrome; it is also performed for the assessment of an underlying malignancy.<sup>2,3</sup>

All doctors should have an understanding of the major complications of this common operation; predominantly, post-operative haemorrhage. Post-operative pain and infections are also recognised presentations following tonsillectomy. We present an interesting case illustrating a rare complication following tonsillectomy, which should be rapidly identified and taken seriously.

## Case report

A 12-year-old female with a history of recurrent tonsillitis was admitted for a routine day-case tonsillectomy. Her past medical history included acne vulgaris, for which she was taking lymecycline. She was otherwise fit and well, had no known allergic drug reactions and no history of general anaesthesia. Her weight was 54.9 kg.

Induction of anaesthesia was performed using propofol. The patient had a grade 1 Cormack and Lehane intubation (full glottis visible during laryngoscopy),<sup>4</sup> with a size 6.5, cuffed, south-facing endotracheal tube. Anaesthesia was maintained using isoflurane. The patient remained stable

during the peri-operative period. The procedure lasted 20 minutes in total.

The surgical procedure was carried out using an UltraCision Harmonic Scalpel (Ethicon Endosurgery, Cincinnati, Ohio, USA). No notable operative complications or abnormalities were encountered.

The patient returned to the day-care ward post-operatively, where she remained stable. She had a single vomiting episode approximately 90 minutes post-operatively and fully settled thereafter. She was discharged home approximately 6 hours following her surgery, as per standard day-case tonsillectomy protocol, with a 10-day supply of analgesics.

The patient re-presented to the emergency department, approximately 15 hours following discharge, with a left-sided neck swelling. She additionally had symptoms of pain and difficulty swallowing. There was no evidence of airway compromise, and there were no complaints of chest, back or abdominal discomfort.

An ENT examination revealed cervicofacial emphysema within the upper neck (principally level 2), more marked on the left side compared to the right, and on both sides of her face (parotid territory). An oral cavity examination revealed no obvious evidence of mucosal breach in either tonsillar fossae. Flexible nasolaryngoscopy showed a slight fullness in the left parapharyngeal region, but the laryngeal inlet was clear. The patient was stable during the assessment period.

She underwent venous cannulation for routine blood tests and intravenous therapy. Her capillary blood gas values were

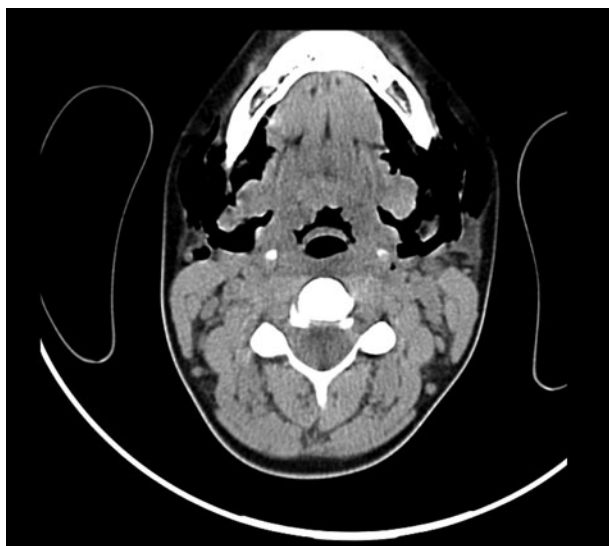


FIG. 1

Axial computed tomography scan of the neck showing bilateral cervical emphysema.

unremarkable. Routine blood investigations showed a mildly raised white cell count, at  $14.2 \times 10^9/l$ . C-reactive protein levels were raised, at 41 mg/l. Venous blood cultures (obtained prior to commencement of antibiotic therapy) did not show any growth after a 5-day incubation period.

The patient was commenced on maintenance intravenous fluids and kept nil by mouth. Co-amoxiclav and metronidazole were administered intravenously, in addition to analgesics.

A chest X-ray showed the presence of some subcutaneous gas within the neck, but no evidence of pneumomediastinum or pneumothorax. A neck computed tomography scan demonstrated widespread surgical emphysema in the neck, extending from the left temporalis region superiorly to the inferior limit of the scan (C7 level) (Figure 1).

The patient was kept nil by mouth for 24 hours and given supplemental nasal oxygen. Her vital signs remained stable during this time.

The patient made an uneventful recovery and was discharged home 3 days after re-admission, at which time the emphysema had abated and she was able to again consume a normal diet. She received intravenous antibiotics during her admission and was discharged on a 5-day course of oral antibiotics (375 mg co-amoxiclav).

## Discussion

Tonsillectomy is one of the most common surgical procedures worldwide. Generally, it is perceived to be a straightforward operation, with reasonably low morbidity and very low mortality (1.03 per 10 000).<sup>5</sup> The main risks encountered peri-operatively are bleeding, airway obstruction, infection, pain, dental trauma and those risks associated with the general anaesthetic. On rare occasions, patients can present with complications such as atlanto-axial subluxation, neurological deficiencies and emphysema (cervicofacial and/or mediastinal).

There are a number of hypotheses for the pathogenesis of cervicofacial emphysema following tonsillectomy. Some authors assume it occurs following disruption to or an underlying defect in the muscular layer of the tonsillar fossa,

which permits the passage of air into the pharyngeal and masticator spaces after tonsil dissection has been performed.<sup>5–7</sup> Once these spaces have been breached, any further positive airway pressure or a Valsalva manoeuvre will lead to an increase in the volume of air within the fascial planes. Indeed, any other damage to the pharyngeal mucosal surfaces during intubation or insertion of the tonsillar gag could, in theory, precipitate surgical emphysema throughout the neck and potentially into the mediastinum. Other theories suggest that damage to the tracheobronchial tree along with positive pressure ventilation precipitates pneumomediastinum, which can then extend into the neck.<sup>5–42</sup>

Benjamin Parish described the first case report of subcutaneous emphysema following tonsillectomy in 1910.<sup>8</sup> The patient was observed in hospital and prescribed bed rest until the emphysema had resolved. Case reports published after 1929 continue to describe conservative management, but with the addition of antibiotics; this coincides with the discovery and subsequent availability of antibiotics. All reported cases of cervicofacial emphysema published in the medical literature from 1910 to 2015 are summarised in Table I.<sup>5–42</sup>

Including our case, there are 48 reports of cervicofacial emphysema following tonsillectomy, recorded in 39 papers. The median patient age was 25 years (range, 2–65 years), and there were 25 females and 23 males. In general, patients were managed conservatively with analgesics, broad-spectrum antibiotics and low-pressure oxygen. Supplemental oxygen has been suggested to have a beneficial effect in the absorption of nitrogen within the planes of the neck by reducing the partial pressure.<sup>6</sup> The majority of patients developed symptoms within 24 hours of surgery; however, 2 patients became symptomatic at day 4 post-operatively.<sup>41,42</sup>

Most patients remained clinically stable, although Ferguson *et al.* reported the case of a four-year-old girl who required the insertion of a chest drain following surgery because of tension pneumothorax.<sup>19</sup> The development of tension pneumothorax immediately following an operation is more in keeping with an anaesthetic complication.

- Cervicofacial emphysema following tonsillectomy is rare
- Conservative management with broad-spectrum antibiotics and low-flow supplemental oxygen is often the treatment of choice
- Serious sequelae requiring airway management are rare
- This paper presents the first case of cervicofacial emphysema following Harmonic scalpel tonsillectomy
- The literature indicates no association between this complication and surgical dissection method

In 2005, Panerari *et al.* reported the case of a 31-year-old female who required tracheostomy insertion because of the extent of the cervical and mediastinal emphysema, which was causing airway obstruction.<sup>29</sup> The patient had the tracheostomy successfully removed after a 5-day period and made a full recovery.

TABLE I  
LITERATURE REVIEW OF POST-TONSILLECTOMY CERVICOFACIAL EMPHYSEMA CASES

Study	Year	Country	Age (y)	Gender	Surgical technique	Management
Parish <sup>8</sup>	1910	USA	28	M	Cold steel	Conservative
Richardson <sup>9</sup>	1912	USA	Adult	M	Cold steel	Conservative
Rosenheim <sup>10</sup>	1922	USA	21	M	Cold steel	Conservative
Richards <sup>11</sup>	1923	USA	12	F	Cold steel	Conservative
			10	M	Cold steel	Conservative
Stein <sup>12</sup>	1923	USA	7	M	Cold steel	Conservative
von Hofe <sup>13</sup>	1930	USA	2	M	Cold steel	Conservative
			4	F	Cold steel	Conservative
			2	M	Cold steel	Conservative
Keen <sup>14</sup>	1932	England	5	M	Cold steel	Conservative
Stevenson <sup>15</sup>	1933	England	25	M	Cold steel	Conservative
MacCready <sup>16</sup>	1935	USA	65	M	Cold steel	Conservative
			48	F	Cold steel	Conservative
Baker <sup>17</sup>	1936	Canada	27	M	Cold steel	Conservative
Melgaard <sup>18</sup>	1946	Denmark	45	F	Cold steel	Conservative
Ferguson <i>et al.</i> <sup>19</sup>	1955	Canada	4	F	Cold steel	Chest drain
Anderson <sup>20</sup>	1958	USA	8	F	Cold steel	Conservative
Prupas & Fordham <sup>5</sup>	1977	USA	22	M	Cold steel	Conservative
Podoshin <i>et al.</i> <sup>21</sup>	1979	Israel	32	M	Cold steel	Conservative
Hampton & Cinnamon <sup>22</sup>	1997	Northern Ireland	18	F	Cold steel	Conservative
			33	F	Cold steel	
Miman <i>et al.</i> <sup>6</sup>	2001	Turkey	11	M	Cold steel	Conservative
Marioni <i>et al.</i> <sup>23</sup>	2003	Italy	34	F	Cold steel with bipolar	Conservative
Nishino <i>et al.</i> <sup>24</sup>	2003	Japan	55	F	Not documented	Conservative
Fechner & Kieff <sup>25</sup>	2003	USA	21	F	Monopolar cautery/argon beam haemostasis	Conservative
Yamine <i>et al.</i> <sup>26</sup>	2004	Canada	36	M	Cold steel	Conservative
Watanabe <i>et al.</i> <sup>27</sup>	2004	Japan	24	M	Not documented	Conservative
Stewart <i>et al.</i> <sup>28</sup>	2004	USA	22	F	Electrocautery dissection	Conservative
Panerari <i>et al.</i> <sup>29</sup>	2005	Brazil	31	F	Cold steel with bipolar	Tracheostomy
Gillot <i>et al.</i> <sup>30</sup>	2005	Belgium	52	F	Cold steel	Re-intubation
			43	F	Not documented	Re-intubation & drainage of pharyngeal/ mediastinal collection
Lima <i>et al.</i> <sup>31</sup>	2005	Brazil	25	M	Not documented	Conservative
Shine <i>et al.</i> <sup>32</sup>	2005	Australia	7	F	Electrodissection	Conservative
Patel & Brookes <sup>33</sup>	2005	England	31	M	Bipolar diathermy	Conservative
Villagra Siles <i>et al.</i> <sup>34</sup>	2006	Mexico	49	F	Cold steel	Conservative
Anwar & Bhattacharjee <sup>35</sup>	2007	Bangladesh	45	F	Cold steel	Conservative
			5	M	Cold steel	Conservative
			50	F	Cold steel	Conservative
			22	M	Cold steel	Conservative
Hung <i>et al.</i> <sup>36</sup>	2009	Taiwan	37	M	Not documented	Conservative
Kim <i>et al.</i> <sup>37</sup>	2010	South Korea	36	F	Monopolar electrodissection	Conservative
Al Omari <i>et al.</i> <sup>38</sup>	2011	Ireland	20	F	Cold steel	Conservative
Koukoutsis <i>et al.</i> <sup>39</sup>	2013	Greece	21	F	Cold steel with bipolar	Conservative
Yelnoorkar & Issing <sup>40</sup>	2014	England	18	M	Bipolar diathermy	Conservative
Bizaki <i>et al.</i> <sup>7</sup>	2014	Finland	29	F	Bipolar scissors	Conservative
Al Jabr & Al Harethy <sup>41</sup>	2014	Saudi Arabia	43	M	Cold steel	Conservative
Tran & Littlefield <sup>42</sup>	2015	USA	30	F	Monopolar electrocautery	Conservative
Current study	2017	Scotland	12	F	Harmonic scalpel	Conservative

Y = years; M = male; F = female

The only other case reports that suggested any significant intervention for the cervicofacial emphysema were two patients of Gillot *et al.*<sup>30</sup> Both of these patients were re-intubated and one returned to the operating theatre for drainage of a cervicomediastinal abscess.

Our case is the first to report this rare complication following routine tonsillectomy performed using the Harmonic scalpel. This method utilises ultrasonic vibration to dissociate hydrogen bonds and thus denature proteins.<sup>43</sup> The blade of the scalpel vibrates at the 'harmonic' frequency of 55.5 kHz. The most obvious benefit of this technique is

the low generation of heat and subsequent potential reduction in lateral thermal damage.<sup>43</sup>

Most of the tonsillectomies in the cases reported were performed using the cold steel approach, usually with ties to the lower tonsillar poles or use of a snare. The recent trend towards alternative methods such as bipolar diathermy dissection, argon beam, laser or coblation does not seem to be associated with higher rates of this rare complication. However, it should be noted that alternative methods are gaining popularity and all complications following tonsillectomy, of any method, should be accurately recorded. We

look with interest for any future reports of this rare complication and the possibility of any association with tonsillectomy technique.

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