Pneumomediastinum and subcutaneous emphysema after dental extraction detected incidentally by regular medical checkup: a case report

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Most cases of pneumomediastinum are caused by iatrogenic injury during surgery on the cervical region and chest or by tracheostomy. It is also well known that emphysema may occur secondary to dental treatment using an air turbine drill, but there have been few cases of emphysema extending to involve the mediastinum. Presented is a rare case in which subcutaneous emphysema and pneumomediastinum developed asymptomatically, probably due to extraction of a mandibular third molar, and were found incidentally on the day after the dental procedure. To avoid subcutaneous emphysema and pneumomediastinum associated with dental treatment and surgical intraoral procedures such as tooth extraction, air turbine drills should be used only when it is essential, **(Oral Surg Oral Med Oral Pathol Oral Radiol Endod 2009;107:e33-e38)**

High-speed air turbine drills are designed for cutting teeth and are most commonly used for dental restorative treatment. Although specific closed turbine systems are available for oral surgical procedures, these drills may be used in exodontia to section teeth and facilitate tooth extraction. These air turbine drills are now in widespread use and are driven by compressed air at 3.5-4.0 kgf/cm^2, rotating at 450,000 rpm. Water sprayers are attached to the tip of the air turbine to cool the friction-induced heat caused by cutting and to wash away the debris. Although emphysema has been reported to occur after dental treatment in association with the use of an air turbine, few cases have extended to involve the mediastinum.[1] We report a case of cervical subcutaneous emphysema and pneumomediastinum occurring after extraction of a mandibular right third molar using an air turbine drill. The emphysema was detected on the day after dental surgery. This paper reports on the diagnosis and treatment of subcutaneous emphysema and pneumomediastinum, along with a review of the literature.

CASE REPORT

A 40-year-old woman attended our hospital (Evaluation and Promotion Center, Tokai University Affiliated Hospital) for a routine medical examination in August 1997. A posterior anterior chest radiograph showed air in the right cervical region and upper right mediastinum, although she had no related symptoms (Fig. 1). The patient reported that extraction of the right mandibular third molar had been performed at a local dental clinic the previous day. Slight swelling was observed over an area ranging from the buccal region to the right cervical region, and subcutaneous crepitus was detected by palpation.

On intraoral inspection, an incision that extended approximately 15 mm from the distal aspect of the right mandibular second molar to the external oblique ridge of the right mandibular ramus was observed. The wound was sutured, and there was slight swelling of the surrounding area, but no crepitus was palpable. Laboratory blood tests and electrocardiography showed no abnormal findings. The patient was diagnosed as having subcutaneous emphysema as a complication of dental extraction using an air turbine drill.

Computerized tomography (CT) was immediately performed to further determine the extent of the emphysema. On CT scans obtained at the suprahyoid level, air was observed in the right submandibular space (SMS), the parapharyngeal space (PPS), the carotid space (CS), the retropharyngeal space (RPS), and the cervical subcutaneous tissue (Fig. 2).

On CT scans obtained at the infrahyoid level, air was observed in the right SMS, PPS, CS, RPS, pretracheal space, and superior mediastinum, and extending across to the opposite side along the superficial layer of the deep cervical fascia (Figs. 3 and 4). To prevent the emphysema from expanding, the patient was immediately hospitalized for bed rest. We then monitored the patient, expecting the emphysema to be spontaneously absorbed, and administered ampicillin at 2 g/day to prevent infection. On the fourth day after hospitalization, subcutaneous crepitus was almost undetectable, and the patient was discharged on the fifth day.

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Received for publication Nov 2, 2005; returned for revision Oct 15, 2008; accepted for publication Dec 8, 2008.
1079-2104/$ - see front matter
© 2009 Published by Mosby, Inc.
doi:10.1016/j.tripleo.2008.12.019

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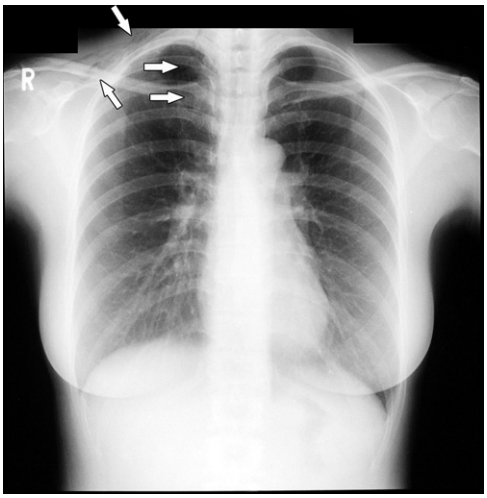

Fig. 1. Posteroanterior chest radiograph showing subcutaneous and mediastinal air (*arrows*).

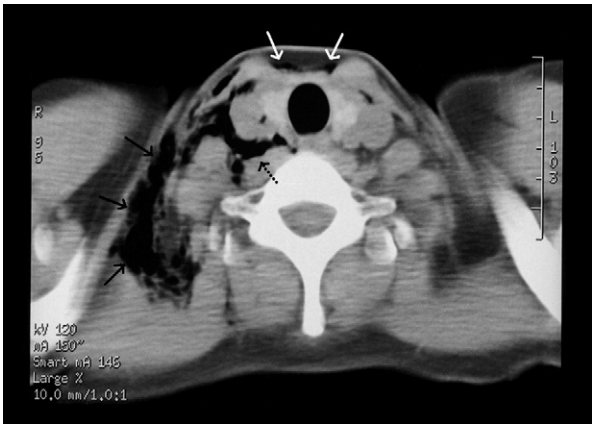

Fig. 3. CT scan at the level of the thyroid gland. Air can be observed in the carotid space (*black arrows)*, retropharyngeal space (*dotted black arrow*), and pretracheal space (*white arrows*).

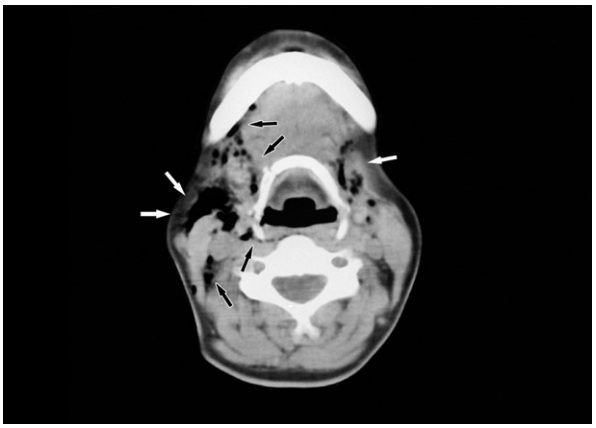

Fig. 2. CT scan at the level of the hyoid bone. Air (*arrow*s) can be observed in the right submandibular space, carotid space, retropharyngeal space, and cervical subcutaneous tissue on the opposite side.

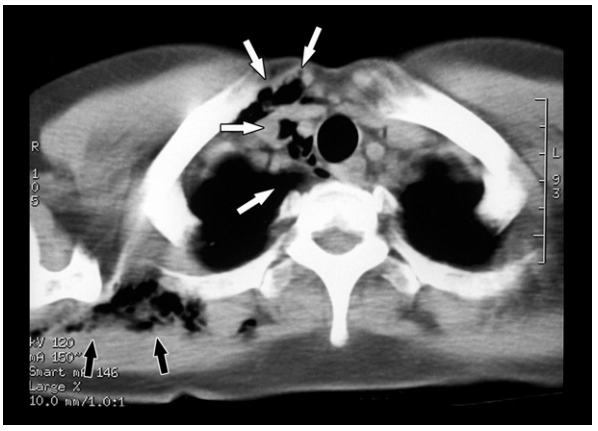

Fig. 4. CT scan at the level of the clavicle. Air can be seen in the superior mediastinum (*white arrows*) and subcutaneous tissue of the back (*black arrows*).

DISCUSSION

Postoperative subcutaneous emphysema and pneumomediastinum after dental treatment were first reported about 100 years ago when a musician blew a bugle immediately after tooth extraction.[1] More recently, subcutaneous emphysema has been associated with dental restorative treatment with a high-speed air turbine drill. Emphysema after tooth extraction is also considered to result from the use of an air turbine drill. Heyman and Babayof[2] reviewed 75 reported cases of subcutaneous emphysema and pneumomediastinum after dental treatment between the years 1960 and 1993. In Table I we review 47 CT-documented cases of subcutaneous emphysema and pneumomediastinum following dental treatment reported between 1994 and 2008.[3,7,11,12,16-54]

Of the 47 patients, 16 were male and 31 female. Eighteen had undergone tooth extraction, 15 tooth restoration, 5 root canal treatment, 3 periodontal treatment, 2 apicectomy, and 3 other dental treatment. The specific dental treatment was unknown for 3 patients. The detailed dental procedures are summarized in Table II.

Of those undergoing extraction, subcutaneous emphysema and pneumomediastinum most often occurred after extraction of the mandibular third molar, in which the tooth was sectioned using an air turbine drill. In such cases, it is likely that the air enters the parapha-

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Table I. Characteristics of 47 case reports of emphysematous complications, arranged chronologically

	Gender and age (yrs)	*Tooth no.*	*Dental procedure*	*Equipment used*	*Gas distribution*				*CT*	*Ref.*
					Subcutaneous	*Orbital*	*Mediastinum*	*Other*		
1	M 27	48	Extraction	AS, HS	+		+	RPS	+	16
2	M 42	31	Restoration	AS, LS	+	+				17
3	F 48	?	Restoration	HS	+	+	+	Pneumothorax		19
4	M 29	48	Extraction	HS	+	+	+			20
5	F 46	27	Restoration	AS	+	+	+	RPS		21
6	M 23	36	FPD prep.	HS	+	+				18
7	F 16	26	Restoration	Air-abrasive device	+	+	+			22
8	F 46	23	Apicectomy	HS	+	+				23
9	M 56	23	Root canal	AS	+	+				23
10	F 61	46, 47	Cleaning	AS	+			RPS		24
11	F 32	48	Extraction	HS	+		+	RPS	+	7
12	F 56	44, 45	Restoration	?	+	+				25
13	M 45	38, 47	Extraction	HS	+		+	RPS, pneumothorax	+	12
14	F 24	48	Extraction	HS	+	+	+		+	26
15	F 26	38	Extraction	HS	+		+	RPS	+	26
16	M 47	47	Extraction	Air rotor	+		+			27
17	F 29	48	Extraction	HS	+		+			28
18	M 45	46, 47, 48	Extraction	HS	+		+			29
19	M 15	36, 37, 38 or 46, 47, 48	Cleaning, placement of molar sealant	?	+		+	RPS		30
20	F 35	31–37?	Root canal	HS	+	+				31
21	F 32	16, 18	Restoration	HS	+	+				32
22	F 58	?	Implamt, mental nerve replacement	Peak flow meter	+					33
23	M ?	48	?	HS	+	+				34
24	F 22	38	Extraction	HS	+		+	RPS	+	11
25	M 21	38	Extraction	HS	+		+	RPS, pneumothorax		3
26	F 31	26	Restoration	HS	+	+		RPS	+	35
27	F 48	46	?	?	+					40
28	F 50	36, 37, 38	Restoration	?	+	+				38
29	F 36	34, 36	Restoration	HS	+	+	+	RPS	+	36
30	F 79	47	Extraction	HS	+		+	RPS	+	37
31	M 68	47, 48	Root canal	HS	+	+	+	RPS	+	39
32	F 39	?	Periodontal ultrasonic scaling and cleaning	?	+	+		RPS		39
33	F 43	25	Restoration	HS	+	+	+	RPS	+	43
34	M 57	36	Restoration	HS	+					44
35	M 7	Multiple	Extraction, root canal	?	+	+				45
36	F 29	?	Restoration	HS	+		+	RPS	+	46
37	F 38	48	Extraction	HS	+		+	RPS	+	41
38	F 7	31 or 41	Extraction	HS	+	+	+	Pneumopericardium	+	42
39	F 5	E	Restoration	HS	+		+			49
40	M 8	Multiple	Extraction	?	+	+	+	Pnuemothorax, pneumoperitoneum		50
41	F 50	37	Restoration	HS	+	+	+	RPS	+	51
42	F 47	36, 37	Root canal	HS	+		+			52
43	F 39	36, 37	?	AS	+			RPS	+	47
44	F 52	34	Restoration	AS, HS	+					48
45	M 21	18, 28, 38, 48	Extraction	HS	+		+	RPS, pnuemothorax, pneumopericardium		53
46	F 43	?	Apicectomy	LS	+		+	RPS, pneumothorax	+	54
47	F 40	48	Extraction	HS	+		+	RPS	+	*

Root canal, Root canal treatment; *FPD*, fixed partial denture; *AS*, air syringe; *HS*, high-speed handpiece; *LS*, low-speed handpiece; *RPS*, retropharyngeal space.
*Present case.

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Table II. Summary of characteristics of 47 case reports of emphysematous complications

Variable	*Incidence*
Gender	
Female/male	31/16
Arch	
Maxilla	8
Mandible	33
Unknown	7
Side	
Right	19
Left	23
Unknown	9
Tooth*	
Central incisor	2 (2/0)
Lateral incisor	0
Canine	2 (0/2)
First premolar	3 (3/0)
Second premolar	2 (1/1)
First molar	13 (10/3)
Second molar	12 (11/1)
Third molar	21 (18/3)
Primary molar	1 (1/0)
Unknown	6
Procedure	
Extraction	18
Restoration	15
Root canal	5
Periodontal	3
Apicectomy	2
Other†	3
Unknown	3
Equipment	
Air syringe	7
High-speed	31
Low-speed	2
Other‡	3
Unknown	7
Gas distribution	
Cervical subcutaneous	47
Orbital subcutaneous	23
Retropharyngeal	22
Mediastinum	29
Other‖	7
Computerized tomography	18

*Numbers in parentheses represent mandibular/maxillary ratio.
†Fixed partial denture preparation, mental nerve replacement, or implant.
‡Air-abrasive device, air rotor, or peak flow meter.
‖>Six pneumothorax, 2 pneumopericardium, and 1 pneumoperitoneum.

ryngeal space via an incision in the mucosa, such as the gingival mucosa. However, there are also case reports of subcutaneous emphysema and pneumomediastinum after restorative treatment and periodontal treatment that required no mucosal incision. Therefore, it is suggested that air from turbine drills can enter the route involved even via a minor breakage of the mucosa. When compressed air generated from air turbine drills enters the parapharyngeal space, it may spread into the mediastinum via the carotid and/or retropharyngeal space.[3] In our review of 47 cases, the retropharyngeal space was found to be the most common route of air reaching the mediastinum in extraction cases, accounting for 16 of the 18 incidences.

The signs of subcutaneous emphysema are edema, sudden cervical swelling without significant tenderness, and crepitus on palpation. The features that suggest pneumomediastinum are dyspnea with a brassy voice, chest or back pain, and Hamman sign.[4] This sign is a crunching and bubbling sound caused by the movement of air accompanying cardiac pulsation in patients with pneumomediastinum. It can be heard along the left sternal border in the third and sixth intercostal spaces, and is detected in approximately 50% of patients with pneumomediastinum. Gray and Hanson[5] reported that abnormal electrocardiographic findings, such as nonspecific T-wave inversion and ST-segment deviation, were observed in ~25% of patients with pneumomediastinum. Imaging diagnosis of pneumomediastinum was previously performed by observing air in the soft tissues on plain film radiographs. Although the presence of pneumomediastinum can be detected with plain film radiograph, it is difficult to determine its extent in detail.[6] Therefore, CT scanning is more reliable and useful at present.

Subcutaneous emphysema is not uncommon when patients complain of swelling and/or pain in the cheek, neck, and chest during and after dental treatment. Mediastinal emphysema may be detected in patients with respiratory distress or may be found later by chest radiograph or CT. There have been cases in which emphysema developed at home in patients who had no symptoms immediately after a dental procedure,[7,8] or in whom respiratory distress developed after several hours owing to the spread of initially mild emphysema.[9,10] Emphysema is sometimes detected >1 day after a procedure, as in the present case.[11] Such a time lag before the development of emphysema may result from reduced sensitivity due to local anesthesia or the gradual spread of progressive emphysema.

It was impossible to determine whether the emphysema of the present patient developed immediately or gradually after tooth extraction, because it was done elsewhere and she had no symptoms. Therefore, it is not clear if use of the air turbine drill is the only reason for subcutaneous emphysema and pneumomediastinum. It has been reported that emphysema can cause dyspnea during treatment in severe cases,[12] airway obstruction has occurred secondary to retropharyngeal emphysema,[13] and emphysema has been complicated by pneumoperitoneum or pneumopericardium.[14]

In the present case, slight cervical swelling, cervical

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subcutaneous crepitus on palpation, and radiographic abnormalities were observed, but the patient had no symptoms. Accordingly, dentists should pay attention to the risk of subcutaneous or mediastinal emphysema developing and progressing despite the absence of symptoms, as in the present case. Emergency physicians should also consider the possibility of subcutaneous emphysema and pneumomediastinum in patients suffering from thoracic pain or breathing problems after dental treatment.

The present patient is considered to be a rare case, because subcutaneous and mediastinal emphysema were found incidentally when a posteroanterior chest radiograph was obtained during a scheduled medical check-up on the day after tooth extraction. For early detection of emphysema, it is necessary to obtain a history and carefully examine the face and neck after dental treatment and then closely follow-up the patient.

Regarding treatment, most patients are cured by simple bed rest and administration of antibiotics.[9,15] However, there have been reports of death due to severe complications, such as mediastinitis, pneumothorax, cardiac tamponade, cardiac failure, and air embolism.[15,16] Even if there are no respiratory symptoms observed at the onset, pneumomediastinum is occasionally associated with gradual expansion of the emphysema and swelling of the surrounding tissues, leading to dyspnea. Therefore, serial CT scans and careful observation of the clinical course are necessary.

The authors thank Seiji Nasu, MD, Department of Radiology, Tokai University School of Medicine, for his kind help.

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