AJNR

A reappraisal of the radiologic findings of acute inflammation of the epiglottis and supraglottic structures in adults.

W R Nemzek, R W Katzberg, M A Van Slyke and L S Bickley

AJNR Am J Neuroradiol 1995, 16 (3) 495-502
http://www.ajnr.org/content/16/3/495

A Reappraisal of the Radiologic Findings of Acute Inflammation of the Epiglottis and Supraglottic Structures in Adults

William R. Nemzek, Richard W. Katzberg, Mark A. Van Slyke, and Lynn S. Bickley

PURPOSE: To evaluate the radiologic characteristic of acute inflammation of the epiglottis and supraglottic structures in adults. **METHODS:** The clinical and radiographic findings in 27 adult patients with epiglottitis (average age, 43 years; range, 28 to 81 years) were compared with those of a control group of asymptomatic subjects (n = 15; average age, 48 years; range, 24 to 79 years). Unusual clinical aspects in the current series included two patients who were positive for human immunodeficiency virus, 1 with acquired immunodeficiency syndrome and Kaposi sarcoma, 3 with emphysematous epiglottitis, 1 with abscess formation, and 1 with laryngeal carcinoma. One patient required emergency tracheostomy. One patient died of pneumonia. **RESULTS:** The ratio of the soft-tissue parameters to the anteroposterior width of the C-4 vertebral body yielded three key parameters of high statistical significance in adult epiglottitis. The ratio of the width of the epiglottis to the anteroposterior width of C-4 should not be greater than 0.33 (sensitivity, 96%; specificity, 100%). The ratio of the prevertebral soft tissue to C-4 should not exceed 0.5 (sensitivity, 37%; specificity, 100%) and the ratio of the width of the hypopharyngeal airway to the width of C-4 should be less than 1.5 (sensitivity, 44%; specificity, 87%). The aryepiglottic folds were enlarged in 85%, and the arytenoids were swollen in 70% of the patient population (specificity, 100%). **CONCLUSION:** These defined radiologic parameters should aid in the diagnosis of acute epiglottitis in adults.

Index terms: Larynx, epiglottis; Neck, inflammation; Neck, radiography

AJNR Am J Neuroradiol 16:495–502, March 1995

In 1940, acute inflammation involving the epiglottis and supraglottic structures was considered primarily an adult disease with a reported mortality rate as high as 50% (1–5). The more fulminant nature of this disease in the pediatric population, however, was recognized in the 1950s, shifting the attention away from the adult patient. Unfortunately, the prevalence and natural history of adult epiglottitis was not well appreciated until the early 1970s (2–13), but has received increasing attention in the medical literature (9–22). The frequency of this condition in our emergency department and the recent but very unusual occurrence of emphysematous epiglottitis in immunocompromised patients were important factors that initiated our retrospective assessment of patients. The wide variability in size of the soft-tissue structures in the supraglottic region, in addition to enlargement of the epiglottis, suggested the need to establish normal ranges in a population of healthy subjects. Our findings are compared with those of the previous literature (10, 23, 24), including a similar study reported in 1977 (25).

Materials and Methods

Ninety-eight patients with epiglottitis were examined and treated between January 1979 and January 1993. Fifty-four (56%) of these were younger than 18 years of age and were not considered in this analysis. Criteria for inclusion in this study were the availability of detailed clinical records and radiographs of adequate quality.

Received November 30, 1993; accepted after revision August 15, 1994.

From the Department of Diagnostic Radiology, University of California Davis Medical Center, Sacramento (W.R.N., R.W.K.); the Department of Radiology and the Division of Emergency Medicine, Pennsylvania State University, Hershey Medical Center, Hershey (L.S.B.); and the University of Rochester School of Medicine and Dentistry, Rochester, NY (M.A.V.).

Address reprint requests to William R. Nemzek, MD, Department of Radiology, University of California Davis Medical Center, 2516 Stockton Blvd, TICON II, Sacramento, CA 95817.

AJNR 16:495–502, Mar 1995 0195-6108/95/1603–0495

Twenty-seven of the 42 adult patients met our study criteria; 15 lacked either clinical records or lateral neck radiographs. Of the 27 patients assessed in this report, 16 were men and 11 were women. The average age of these subjects was 43 years (range, 28 to 81 years). All cases of epiglottitis were confirmed by laryngoscopy or autopsy.

Clinical records were reviewed for the presence of common clinical hallmarks of epiglottitis including sore throat, dysphagia, drooling, and stridor. Clinical parameters that were tabulated included body temperature, white blood cell count, blood and throat culture findings, laryngoscopic and/or autopsy findings, necessity for airway assistance, overall therapy, and seasonal occurrence. Other clinical information that was collected included human immunodeficiency virus antibody status when known, known risk factors, and, when available, pathologic findings in patients with surgical intervention and/or autopsy.

Lateral neck films of the symptomatic patients with epiglottitis (n = 27) were compared with those of an age-matched group of patients with no symptoms of laryngeal/pharyngeal inflammation (n = 15, 5 men and 10 women; average age, 48 years; range, 24 to 79 years). The asymptomatic group of patients had neck radiographs for the evaluation of chronic musculoskeletal pain and were randomly selected from our outpatient neurology clinic. These subjects had no febrile illness or trauma. Subjects with marked degeneration of the bony anatomy were excluded in order to simplify our measurement uniformity.

A previously standardized radiographic technique was used for all subjects. The lateral and anteroposterior (AP) radiographs had a target film distance of 100 cm and were exposed at 70 kilovolts (peak), 4 mAs, with a focal spot size of 0.6 mm. The soft-tissue structures were assessed with simple linear measurements using the lateral neck radiographs as follows (Fig 1A–C): *prevertebral soft-tissue width* represents the horizontal width of the soft tissues just anterior to the midheight of the C-4 vertebral body; *basal width of the epiglottis* is the width of the epiglottis measured from the vallecula anteriorly to the laryngeal airway posteriorly perpendicular to the long axis of the epiglottis; *width of the hypopharyngeal airway* is the maximum AP width of the supraglottic airway at the level of the vallecula; and *width of the proximal subglottic tracheal airway* is the AP dimension of the subglottic airway.

The width of the C-4 vertebral body was measured at its midheight level on the lateral radiographs. Figure 1C shows these measurements with the comparative normal lateral neck radiograph (Fig 1A) and a simplified diagram of important soft-tissue structures (Fig 1B). Measurements in a 39-year-old man with epiglottitis are shown in Figure 2A and the diagram in Figure 2B.

The thickness of the arytenoid and the aryepiglottic folds were also qualitatively assessed and graded on a scale of 1+ to 4+ (1+ indicates slightly swollen; 2+, moderately swollen; 3+, markedly swollen; 4+, massively swollen) (14).

The ratio of the measured parameters on the radiographs to the AP width of the C-4 vertebral body provided correction for radiographic magnification and established a simplified mechanism for standardizing the anatomy. The mean and standard deviation of all values were determined. The mean values of each measurement ratio were compared with the mean values of similar anatomic regions in the asymptomatic patient population. These values were assessed with the Student's t test to establish possible statistical significance ($P < .05$). Any of the qualitative indexes of 2+ or greater were considered definitely abnormal.

Results

The average clinical time to presentation in the emergency room was 2.4 days (range, 12 hours to 8 days), but the severity of radiologic findings did not seem to correlate with the duration of symptoms. Sixty percent of the patients were febrile (temperature greater than 37°C), and 71% had white blood cell counts greater than 12 000 cells per microliter. The average white blood cell count was 18 400. Throat and/or blood cultures were available in 60% of the patients; of the eight throat cultures obtained, four were positive, two for β-hemolytic streptococcus group A, one for *Haemophilus influenzae* B, and one for only mixed flora. Therefore, throat cultures were unreliable and positive in only 38%. Of the 11 patients having blood cultures, 5 were positive: 2 for *Haemophilus influenzae* B, 2 for *Streptococcus pneumoniae,* and one for viridans streptococci. Two patients were positive for human immunodeficiency virus and one of these had acquired immunodeficiency syndrome (AIDS). One patient required emergency tracheostomy and eventual surgical exploration demonstrated an ulcerated epiglottis. A second patient required surgical exploration for drainage and debridement of an associated abscess. Most were treated medically with intravenous antibiotics and rapidly improved.

Representative radiologic manifestations of selected cases are shown in Figures 2 through 7. Minimal enlargement of the epiglottis is illustrated in Figure 3, and moderate to massive enlargement in Figures 2A, 4, and 6. Enlarged aryepiglottic folds are demonstrated in Figures 2A and 3. Arytenoid enlargement is seen in Figures 6 and 7. Prevertebral soft-tissue swelling (Figs 2A and 3) and ballooning of the hypopharynx (Fig 2A) were frequent findings. One of the two patients who had emphysematous

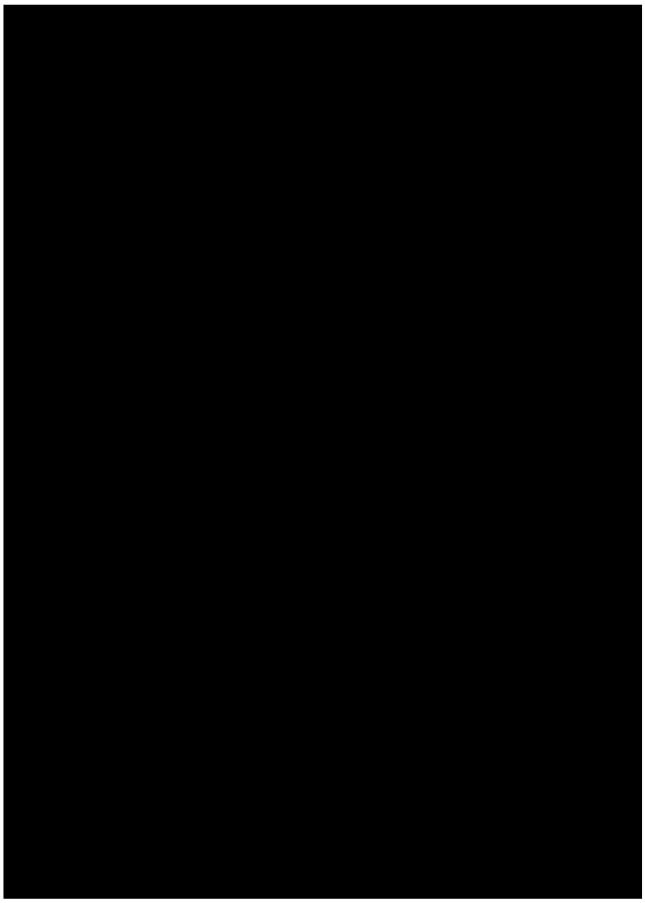


Fig 1. Normal soft-tissue structures of the neck.

A, Lateral neck radiograph shows laryngeal soft-tissue structures and cervical spine of an asymptomatic subject.

B, Simplified line diagram of important soft-tissue structures shown in a lateral neck radiograph.

C, Diagram outlining prominent soft-tissue features. The labeled parameters represent the actual measurements taken from the lateral neck radiograph. Ratios were obtained by dividing these measurements by the AP width of C-4 vertebral body. *PVST* indicates prevertebral soft-tissue width; *HPW*, hypopharyngeal airway width; *SGTA*, subglottic tracheal airway width; and *C4*, AP width of the vertebral body of C-4.

epiglottitis on presentation is shown in Figure 5. The lateral neck radiograph of the patient with AIDS is shown in Figure 6.

The thickness of the aryepiglottic folds was qualitatively graded 2+ or greater in 23 (85%) of the 27 symptomatic patients. Nineteen (70%) of the 27 patients with epiglottitis had arytenoid swelling graded 2+ or greater. One patient had massive arytenoid swelling on the radiograph and a normal epiglottis at endoscopy (Fig 7).

Fig 2. *A*, Laryngoscopically proved case of epiglottitis. Lateral neck soft-tissue structures in a 39-year-old man with a moderate degree of epiglottic swelling (*arrows*). The arytenoid (*letter A*) and aryepiglottic folds (*arrowheads*) are also enlarged. Note that width of epiglottis is measured perpendicular to its long axis (*dotted line*) at base.

B, Prominent soft-tissue features. Labeled parameters represent actual measurements taken from lateral neck radiograph. *PVST* indicates prevertebral soft-tissue width; *SGTA*, subglottic tracheal airway width; *A/E FOLDS*, aryepiglottic folds; *ARYT*, arytenoid; and *C4*, AP width of the vertebral body of C-4.

AP radiographs offered no useful information in any of these patients.

Comparison with asymptomatic subjects demonstrated the anticipated high level of statistical significance when measurements were compared. The results of the parametric data analyses are listed in Table 1. Setting ratios of the soft-tissue structures to the width of the C-4 vertebral body allowed simplified measures for documenting the degree of abnormality at presentation and comparing changing clinical status. Table 2 demonstrates diagnostic numerical ratios that can be used conveniently in the clinical setting. For example, the average ratio of the epiglottic width to the C-4 vertebral body width of the patient population was 1.0 compared with about 0.25 in the asymptomatic group. The ratio of the prevertebral soft-tissue structures to the C-4 vertebral body was 0.5 in the patients with epiglottitis compared with about 0.25 in the control group. The hypopharyngeal airway ratio to C-4 was about 1.5 in the symptomatic population versus 0.85 in the asymptomatic group. There was no significant difference in the subglottic tracheal airway ratio between symptomatic and asymptomatic subjects. The sensitivities and specificities are listed in Table 3. A more detailed presentation of the parametric data is depicted graphically in Figure 8.

Discussion

This study of 27 cases of confirmed epiglottitis suggests a greater variability in the clinical and radiographic manifestation of adult epiglot-

Fig 3. Grossly edematous aryepiglottic folds. Lateral neck radiograph of a 38-year-old woman shows remarkable enlargement of aryepiglottic folds (*arrowheads*), prevertebral soft tissues (*open arrows*), and minimally enlarged epiglottis (*white arrow*). Anteriormost border of epiglottis is not well seen on this film.

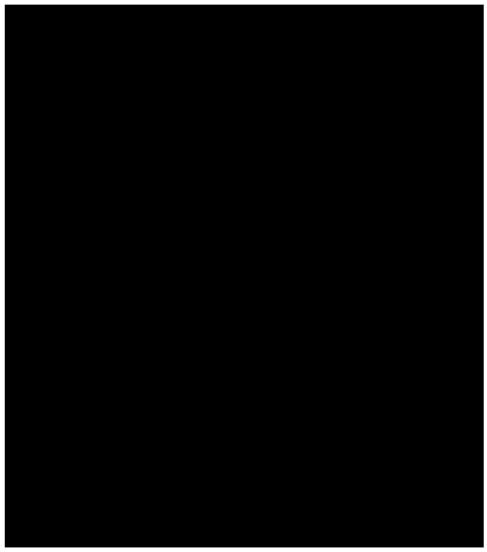


Fig 4. Lateral neck radiograph shows an example of a massively swollen epiglottis (*arrows*).

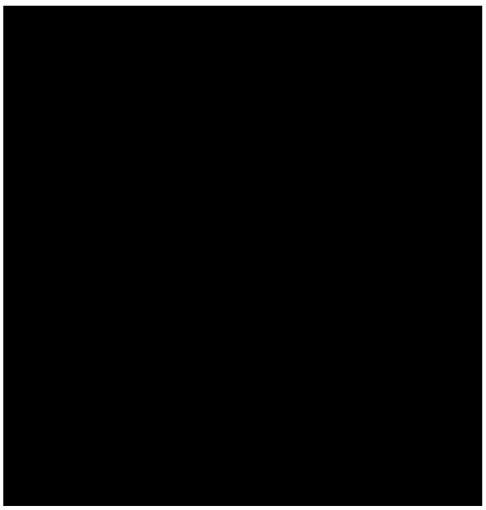


Fig 5. Emphysematous epiglottitis in a 74-year-old man. Swelling of epiglottis and soft-tissue lucencies representing gas (*arrows*). There is minimal widening of the hypopharyngeal airway with normal-appearing prevertebral soft tissue.

titis than previously suggested (10, 23, 25). In particular, 2 patients were positive for human immunodeficiency virus, one of whom had AIDS. There were 2 cases of emphysematous epiglottitis in 36- and 74-year-old men. A third patient was noted on computed tomography to have soft-tissue gas and abscess formation 4 days after presentation. Another unusual association in this series was the presence of laryn-

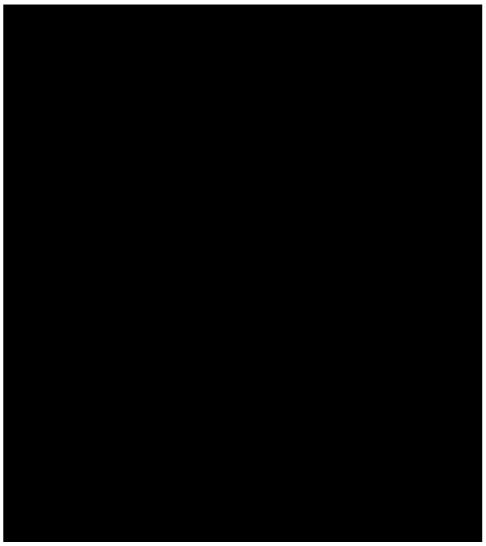


Fig 6. Lateral neck radiograph demonstrating epiglottitis in a 36-year-old man with AIDS. Note marked abnormalities of soft-tissue structures in and around epiglottis, enlarged epiglottis (*long arrow*), and swollen arytenoid (*short arrows*). There is no swelling of prevertebral soft tissues. This patient subsequently died of sepsis.

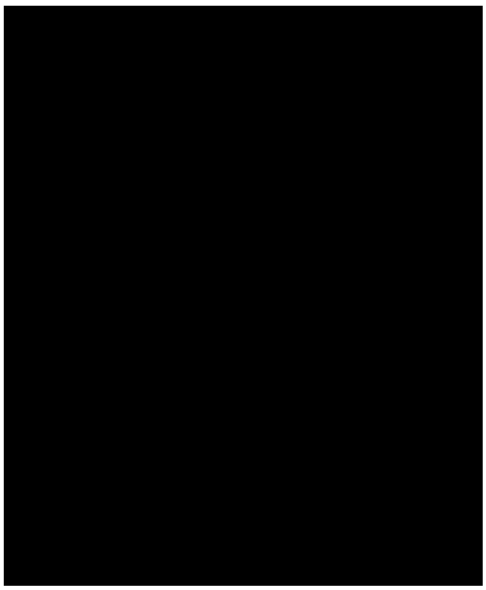


Fig 7. Lateral neck radiograph of a 42-year-old man with 3 days of sore throat and dysphagia. There is massive swelling of the arytenoids (*arrow*). At endoscopy the epiglottis was normal, and there was supraglottic and arytenoid edema.

geal carcinoma as an underlying condition. There was one fatality in our series, a 28-year-old man with AIDS. In addition to Kaposi sarcoma, there was infiltrating candidiasis in the aryepiglottic folds. The patient died of a staphylococcus pneumonia with sepsis from this organism. Haberman et al (26) suggest that *Candida* epiglottitis can actually be a relatively benign disease as they described this association in an otherwise healthy 75-year-old woman.

Common signs and symptoms of adult epiglottitis in decreasing frequency and increasing severity are sore throat, dysphagia, drooling, and stridor. In our patient series, 60% were febrile and 71% had elevated white blood cell

TABLE 1: Ratios of lateral neck film measurements to C-4 vertebral body width

Quantitative Parameters	Epiglottitis* Patients, n = 27	Control Subjects, n = 15	*P* Value
EW	1.00	0.22	.00001
PVST	0.48	0.26	.0008
HPW	1.49	0.85	.002
SGTA	1.15	1.28	.54

Note.—EW indicates epiglottic width; PVST, prevertebral soft-tissue width; HPW, hypopharyngeal airway width; and SGTA, subglottic tracheal airway width.

* Proved with laryngoscopy or autopsy.

TABLE 2: Diagnostic threshold of radiologic parameters for epiglottitis

Soft-tissue Parameters	Diagnostic Threshold, ratios	Patterns at or above Threshold	
		Epiglottitis, n = 27 (%)	Control, n = 15 (%)
PVST*	>0.5	10 (37)	0 (0)
EW*	>0.33	26 (96)	0 (0)
HPW*	>1.5	12 (44)	2 (13)
SGTA	>1.0	18 (67)	13 (87)
A/E folds	≧2+	23 (85)	0 (0)
Arytenoid	≧2+	19 (70)	0 (0)

Note.—PVST indicates prevertebral soft-tissue width; EW, epiglottic width; HPW, hypopharyngeal airway width; SGTA, subglottic tracheal airway width; and A/E, aryepiglottic.

* Statistically significant (defined as $P < .01$, Student's t test).

Fig 8. Average values of measured soft-tissue parameters used in the evaluation of epiglottitis. *Bow-tie* indicators represent average values of measured parameters of soft-tissue structures of symptomatic and asymptomatic patients. Significant differences were noted in prevertebral soft-tissue width, epiglottic width, and hypopharyngeal airway width. PVST indicates prevertebral soft-tissue width; EW, epiglottic width; HPW, hypopharyngeal airway width; and SGTA, subglottic tracheal airway width. *Asterisk* indicates $P < .0008$; *double asterisk*, $P < .00001$; *triple asterisk*, $P < .002$.

counts. Organisms cultured were β-hemolytic streptococcus group A and *Haemophilus influenzae* B. Prior literature indicates a positive throat culture rate in the range of 45% to 61% (14, 27–30). Throat cultures were positive in only 38% of our patient group. Blood cultures were positive in 45%.

Ampicillin is given empirically because of the possibility of *Haemophilus* infection, but currently the majority of cases have no specific pathogenic organism identified (17–19, 31, 32). Steroids have been advocated to decrease the inflammatory component of edema (25).

The death of George Washington is postulated to represent an early recorded case of epiglottitis (33). In the 1950s, epiglottitis was regarded as a pediatric disease; the adult counterpart was seldom mentioned. Recent reports of adult epiglottitis are more frequent in the medical literature (17–22, 31). The more chronic nature of the current case material in comparison with a previous study in 1977 suggests a shift in the clinical association and manifestations. Epiglottitis may be a more indolent disease in adults than in the pediatric population, partly because of the larger diameter and more rigid structure of the adult airway (4, 31). Most adults do not require intubation nor tracheostomy for airway obstruction (21, 22, 31).

Lateral radiographs of the neck are useful in acute epiglottitis. AP radiographs were not found to be of value. Neck radiographics should be obtained with the patient in the upright position if possible, to avoid pooling of secretions posteriorly, which could increase the degree of airway obstruction. Computed tomography examinations are useful to exclude the possibility of abscess formation and emphysematous changes.

In the study by Stankiewicz (34), lateral neck films were found to be extremely inaccurate for the diagnosis of epiglottitis. In a retrospective review, the plain films were interpreted as positive in only 31% of patients with epiglottitis. Jones and Holland reported a 33% incidence of false-positive diagnosis for epiglottitis when normal lateral neck radiographs were presented to a group of five radiologists (35). The reason for errors of this magnitude is unclear. Perhaps the films used were of poor quality, or the radi-

TABLE 3: Characteristics of measurements

Soft-tissue Parameters	Diagnostic Threshold	Sensitivity, %	Specificity, %
PVST*	>0.5	37	100
EW*	>0.33	96	100
HPW*	>1.5	44	87
SGTA	>1.0	67	13
A/E folds	≧2+	85	100
Arytenoid	≧2+	70	100

Note.—PVST indicates prevertebral soft-tissue width; EW, epiglottic width; HPW, hypopharyngeal airway width; SGTA, subglottic tracheal airway width; and A/E, arytenoid.

* Statistically significant (defined as $P < .01$, Student's t test).

ologists were uncomfortable making or excluding the diagnosis of epiglottitis, an unusual clinical problem in the adult patient. Rothrock states that epiglottitis in the adult may have a milder presentation than its pediatric counterpart, and the radiographic findings may be more subtle (24). Another explanation for the high false-negative rate is the fact that in adults multiple anatomic sites in the larynx and oropharynx may be inflammed, and the epiglottis may not always be the most abnormal structure (33). Figure 7 illustrates a patient with a normal epiglottis, but the arytenoids are massively swollen. The term *supraglottitis* has been used to describe the adult disease, because the involvement may extend to the soft palate, base of tongue, uvula, and vallecula (24). The prevertebral soft tissues were also often involved in our series. There was wide variability in the edema of the epiglottis and supraglottic structures in our patient population. The misdiagnosis of epiglottitis can also be attributed to the lack of specific parameters that can be easily and consistently applied, and we have therefore attempted to develop criteria to aid in the radiologic diagnosis of adult epiglottitis. We compared the lateral neck films of 15 asymptomatic control subjects with those of our patient population to develop standards for comparison using routine radiographic protocols. We used a ratio of the soft-tissue structures to the AP width of the C-4 vertebral body on the lateral neck radiograph to provide an internal standard. We found three key parameters of high statistical significance in adult epiglottitis: the ratio of the width of the epiglottis to the AP width of the C-4 vertebral body should not be greater than 0.33; the ratio of the prevertebral soft-tissue width to the AP width of the C-4 vertebral body should not be greater than 0.5; and, finally, the ratio of the width of the hypopharyngeal airway to the width of the C-4 vertebral body should not be greater than 1.5. These findings may be helpful in confirming or better establishing the well-known qualitative findings that have been described previously (10, 23, 25). Widening of the hypopharyngeal airway is a nonspecific sign that may be associated with any cause of upper airway obstruction such as croup. This sign also showed some overlap with the healthy group. There was swelling of the aryepiglottic folds in 85% and enlargement of the arytenoids in 70% of our patient population. Our data compare favorably with those of Rothrock et al, who found the ratio of the epiglottic width to the C-3 vertebral AP width should be less than 0.5 in normal adults. Our cut-off ratio of 0.33 is based on the normal measurements from our control population. A larger control group might have produced some false-positive results, with overlap with the abnormal group. Rothrock also found that the ratio of the aryepiglottic fold–width to the C-3 AP vertebral width of more than 0.35 and the ratio of epiglottic height to epiglottic width of 0.6 or more were 100% sensitive and specific in differentiating between adults with and without epiglottitis (24). John et al (36) found that enlargement of the aryepiglottic folds is highly sensitive and specific for epiglottitis in children. Arytenoid swelling of the arytenoids was not as accurate. Our qualitative assessment of these areas is in agreement with their findings.

The patient in Figure 7, with a normal epiglottis but massively swollen arytenoids, would have been called healthy if only the epiglottis were evaluated. Our parametric data are not restricted to the epiglottis and include other structures that are potentially involved in adult supraglottitis.

We feel a more encompassing set of parameters may be of greater value in the diagnosis of adult epiglottitis. The availability of rapid, reasonably priced magnetic resonance imaging in the emergency department may also better define the nature and extent of adult supraglottitis.

Conclusion

Radiologic parameters for acute supraglottitis in the adult are defined. Our clinical series of adult epiglottitis and supraglottic inflammation suggests the occurrence of clinical risk factors and a tendency toward chronic disease in these patients. Emphysematous epiglottitis appears to be a new manifestation of a well-known and well-described clinical entity.

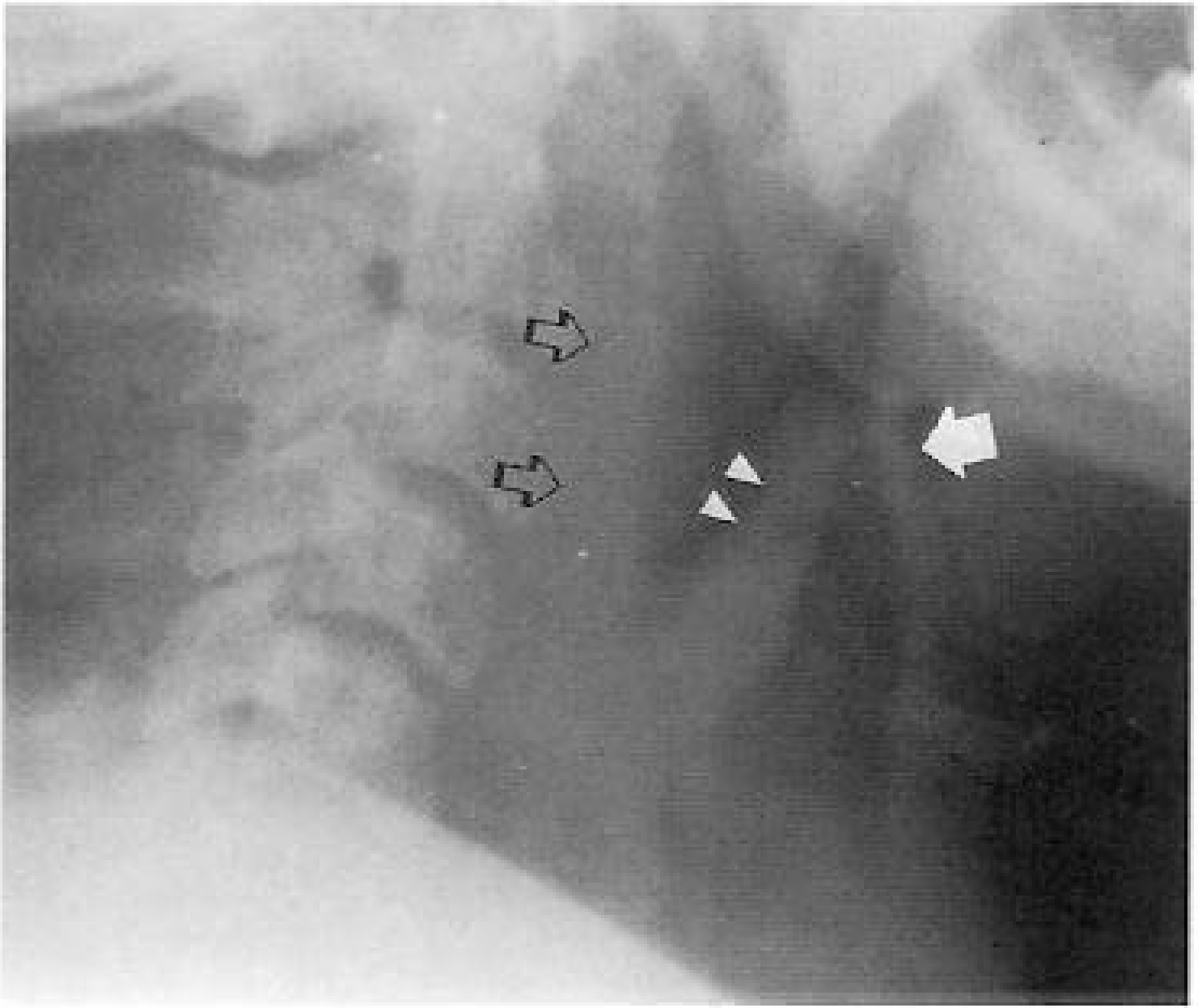
References

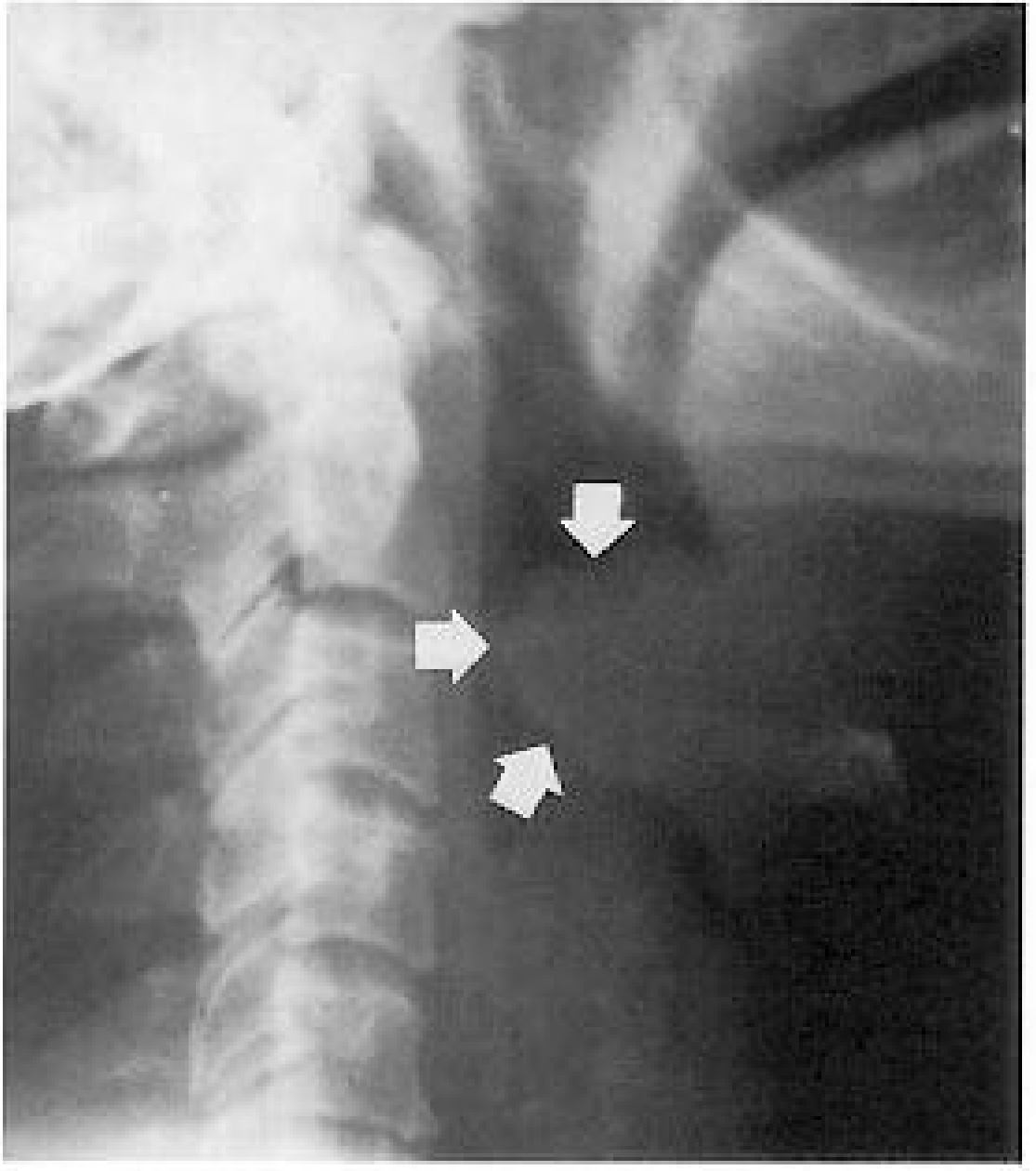
1. Brown JM. Acute infections of the epiglottis. *Arch Otolaryngol* 1940;32:631–641
2. Robbins JP, Figz-Hugh AS. Epiglotitis in the adult. *Laryngoscope* 1971;81:700–706
3. Morgenstein KM, Abramson AL. Acute epiglottitis in adults. *Laryngoscope* 1971;81:1066–1073
4. Hawkins DB, Miller AH, Sachs GB, Benz RT. Acute epiglottitis in adults. *Laryngoscope* 1973;83:1211–1220
5. Kander PL, Richards SH. Acute epiglottitis in adults. *J Laryngol Otol* 1977;91:295–302

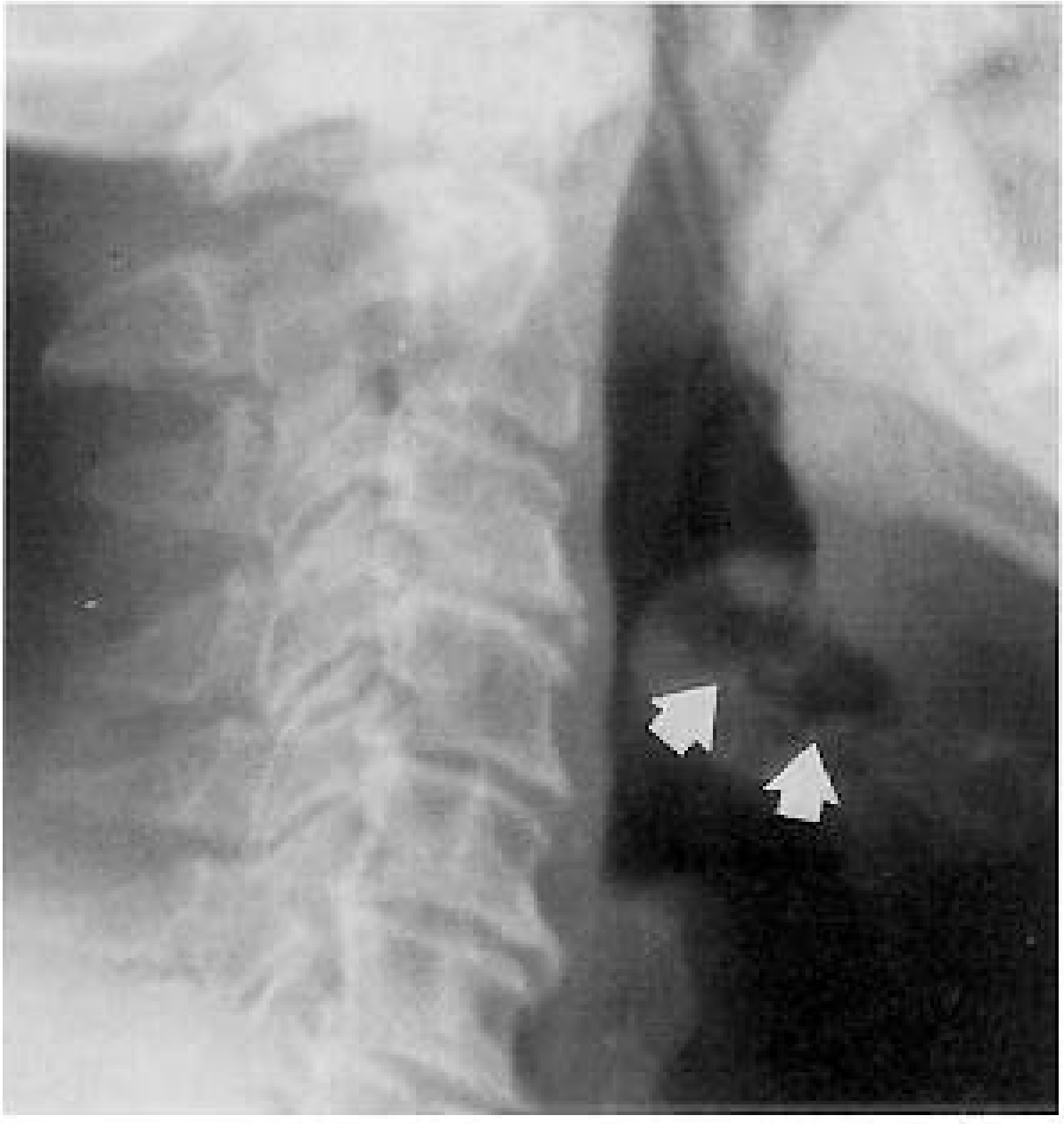
6. Heller MF. Supralaryngeal and laryngeal cellulitis in adults. *Arch Otolaryngol* 1964;80:110–113
7. Garfinkel HJ, Brown R, Kabins SA. Acute infections epiglottitis in adults. *Ann Intern Med* 1969;70(2):289–294
8. Bass JW, Steele RW, Wiebe RA. Acute epiglottitis. *JAMA* 1974; 229(6):671–675
9. Cohen EL. Epiglottitis in adults. *Ann Emerg Med* 1984;13(8): 620–623
10. Yenson AC, Deeb ZE, DeFries HO. Acute epiglottitis in the adult. *Laryngoscope* 1985;95:289–291
11. Mayosmith MF, Hirsch PJ, Wodzwski SF, Schiffman FJ. Acute epiglottitis in adults. *N Engl J Med* 1986;314(18):1133–1139
12. Baker AS, Eavey RD. Adult supraglottitis. *N Engl J Med* 1986; 314:1185–1186
13. Chrisson RE, Noss J, Gerberding JL, Samde MA. Clinical aspects of adult epiglottitis. *West J Med* 1986;144:700–703
14. Baxter JD. Acute epiglottitis. In: English A, ed. *Otolaryngology*. 1986;3:1–8
15. DeVita MA, Wagner IJ. Acute epiglottitis in the adult. *Critical Care Med* 1986;14(2):1082–1083
16. Ossoff RM, Wolff AP, Ballenger JJ. Acute epiglottitis in adults: experience with cases. *Laryngoscope* 1980;90:1155–1161
17. Carenfelt C. Etiology of adult infectious epiglottitis in adults: septic vs local infection. *Scand J Infect Dis* 1989;21:53–57
18. Shih L, Hawkins DB, Stanley RB. Acute epiglottitis in adults. *Ann Otol Rhinol Laryngol* 1988;97:527–529
19. Rivon RP, Murray JAM. Acult epiglottitis: is there a concensus on diagnosis and treatment? *Clin Otolaryngol* 1991;16:338–344
20. Rothstein SG, Persky MS, Edelman BA, Gittleman PE, Stroschien M. Epiglottitis in AIDS patients. *Laryngoscope* 1989;99:389–392
21. Ryan M, Hunt M, Snowberger T. A changing pattern of epiglottitis. *Clin Pediatr* 1992;Sept:532–535
22. Wolf M, Strauss B, Kronenberg J, Leventon G. Conservative management of adult epiglottitis. *Laryngoscope* 1990;100:183–185
23. Schumaker HM, Doris PE, Birnbaum G. Radiographic parameters in acute epiglottitis. *Ann Emerg Med* 1984;13(8):588–590
24. Rothrock SG, Pignatiello GA, Howard RM. Radiologic diagnosis of epiglottitis: objective criteria for all ages. *Ann Emerg Med* 1990; 19:978–982
25. Schabel SL, Katzberg RW, Burgener FA. Acute inflammation of epiglottis and supraglottic structures in adults. *Radiology* 1977; 122:601–604
26. Haberman RS, Becker ME, Ford CN. Candida epiglottitis. *Arch Otolaryngol* 1983;109:770–771
27. Burns JE, Hendley JO. Epiglottitis. In: Mandell GL, Douglas RG Jr, Bennet JE, eds. *Principles and Practice of Infectious Diseases*. 1988;44:372–375
28. Poole CA, Altman DH. Acute epiglottitis in children. *Radiology* 1963;80:798–805
29. Branefons-Helander P, Pai-Henry Jeppson. Acute epiglottitis: a clinical, bacteriological and serological study. *Scand J Infect Dis* 1975;8:103–111
30. Dejani AS, Asmar BL, Thirumoorthi MC. *Systemis Haemophilus influenzae* disease: an overview. *J Pediatr* 1979;94(3):335–364
31. Fontanarosa PB, Polsky SS, Goldman GE. Adult epiglottitis. *J Emerg Med* 1989;7:223–231
32. Shapiro J, Eavey RD, Baker SB. Adult supraglottitis: a prospective analysis. *JAMA* 1988;259:563–567
33. Scheidemandel HH. Did George Washington die of quinsy? *Arch Otolaryngol* 1976;102:519–521
34. Stankiewicz JA, Bowes AK. Croup and epiglottitis: a radiologic study. *Laryngoscope* 1985;1159–1160
35. Jones JL, Holland P. False positives in lateral neck radiographs used to diagnose epiglottitis. *Ann Emerg Med* 1983;12(12):797
36. John SD, Swischuk LE, Hayden DK, Freeman DH. Aryepiglottic fold width in patients with epiglottitis; where should measurements be obtained. *Radiology* 1994;190:123–125

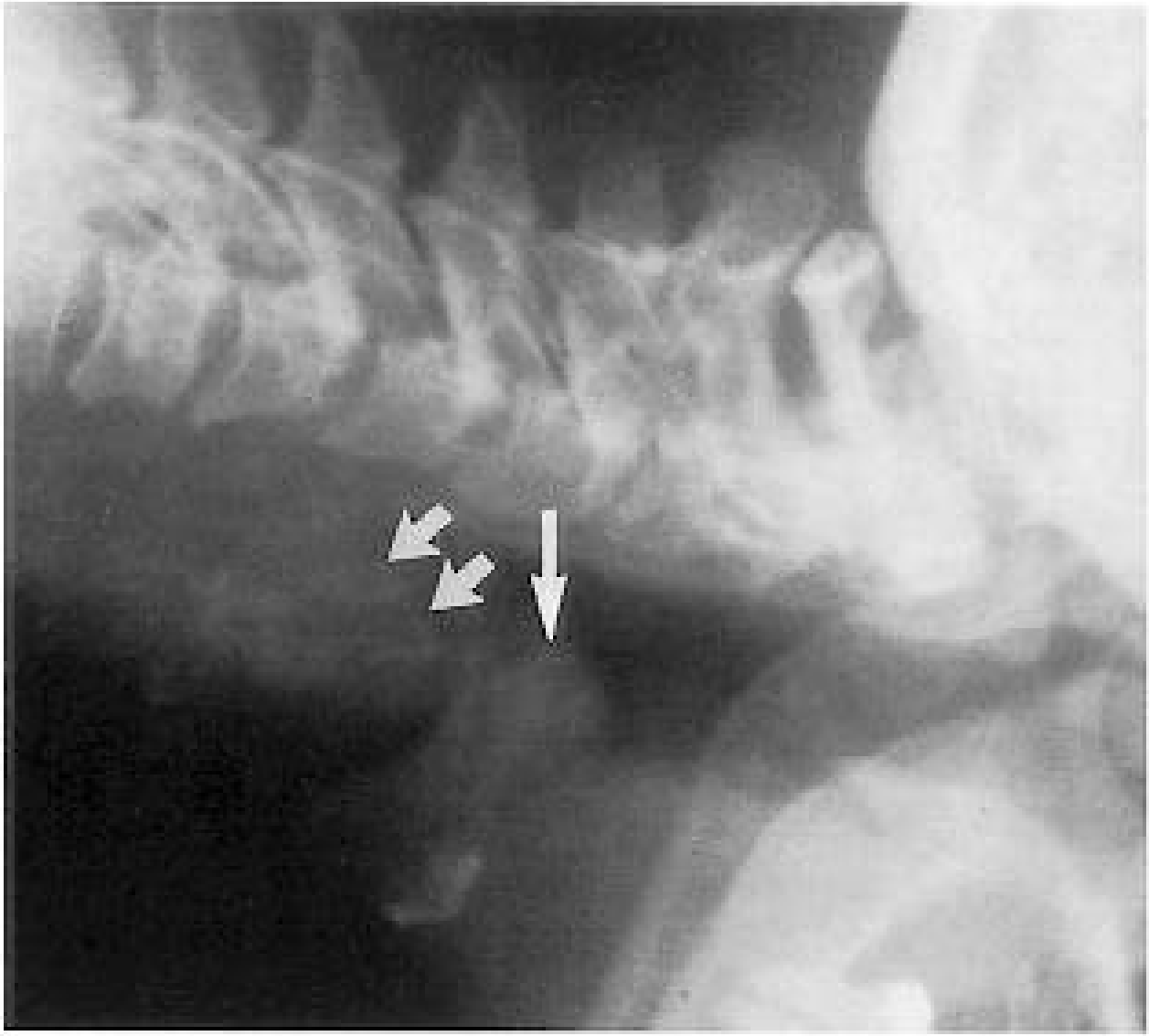
A

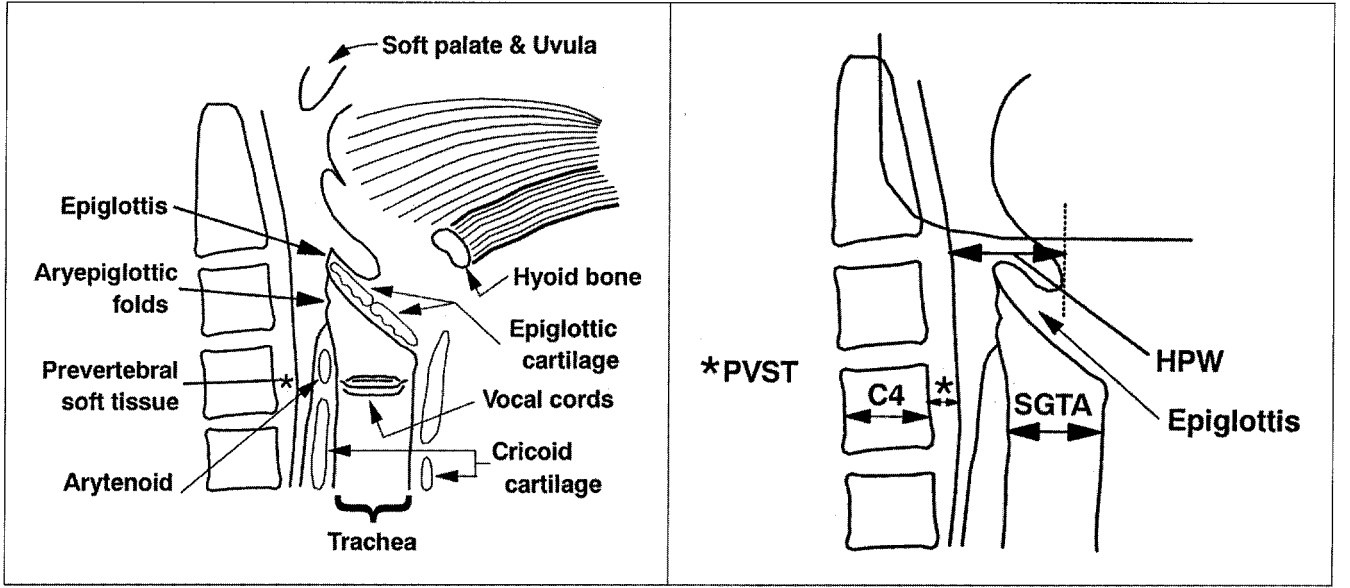
A



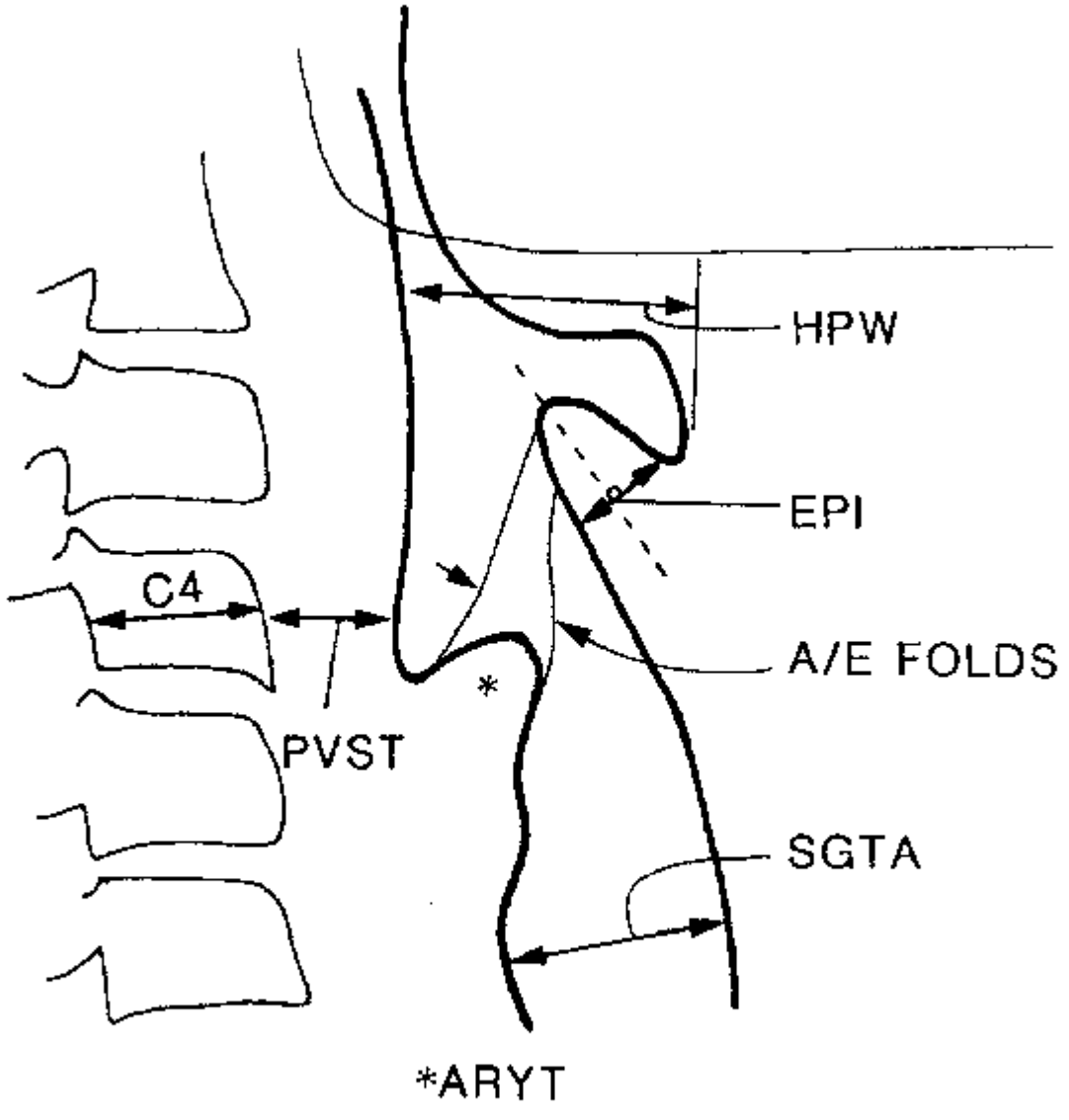




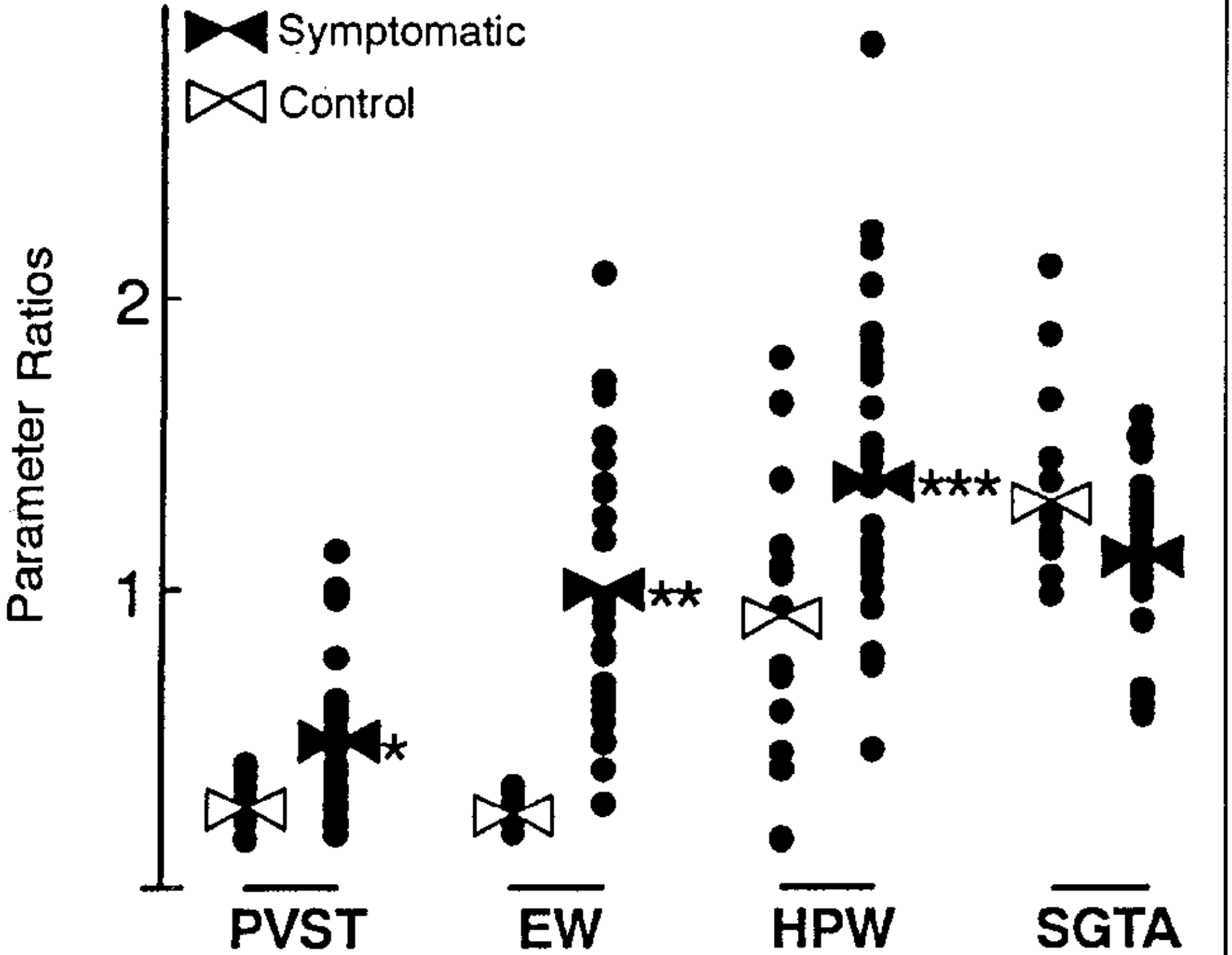



Soft palate & Uvula
Epiglottis
Aryepiglottic folds
Hyoid bone
Epiglottic cartilage
Prevertebral soft tissue
*
Vocal cords
Arytenoid
Cricoid cartilage
Trachea
*PVST
C4
*
SGTA
HPW
Epiglottis

B C



B


Symptomatic
Control
Parameter Ratios
2
1
*
**
***
PVST
EW
HPW
SGTA