

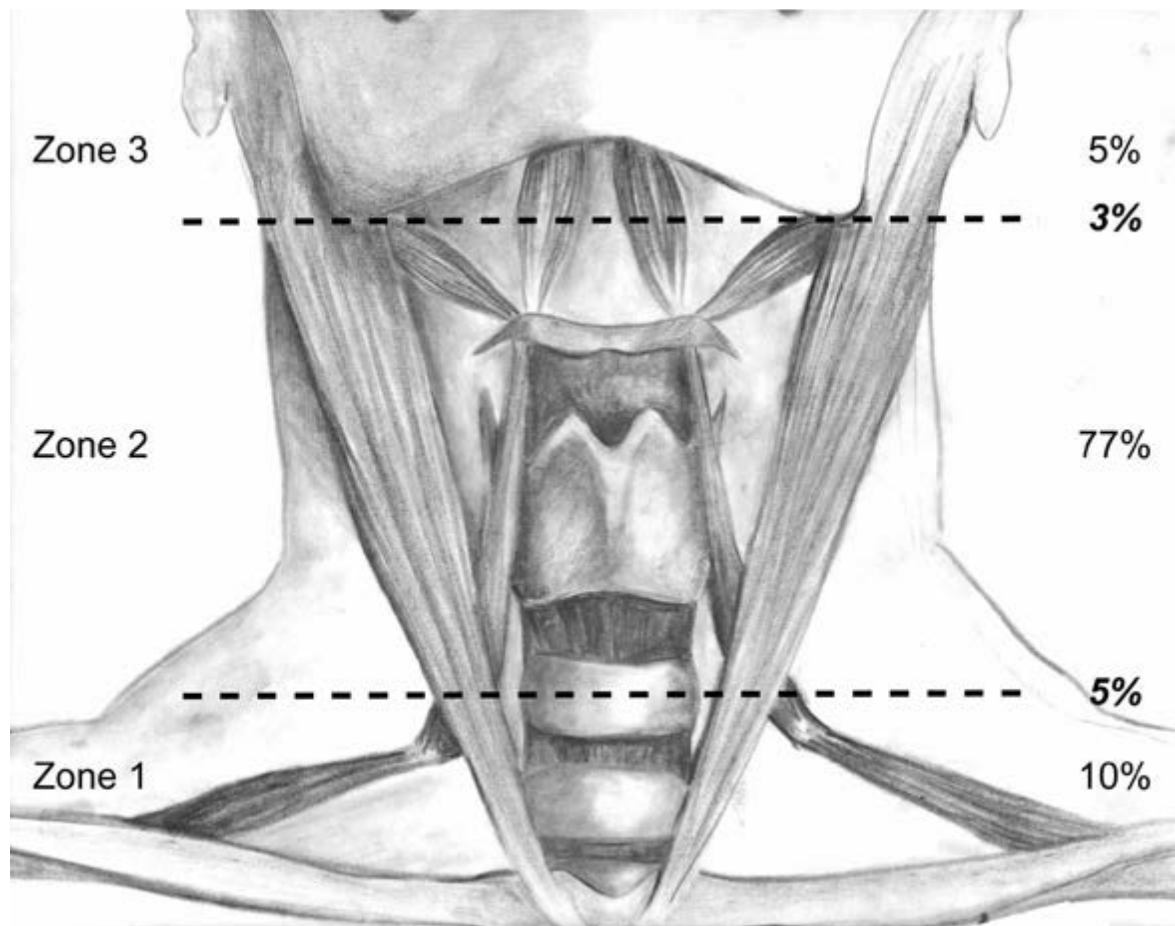
# Penetrating Neck Trauma

## OBJECTIVE:

Provide guidelines for the management of a penetrating injury to the neck, specifically as it relates to the need for operative exploration and the ordering of diagnostic studies.

## Guidelines:

- Do not deviate from ATLS protocol
  - EARLY intubation is key. *Emergency cricothyrotomy or tracheostomy may be complicated by release of contained hematoma with potentially disastrous consequences. Proceed only in extremis*
1. If the neck injury is associated with any of the following conditions, then the patient should be taken immediately to the operating room for exploration:
    - a. Shock.
    - b. Active hemorrhage.
    - c. Expanding hematoma.
    - d. Zone II penetrating injury (thru the platysma)
    - e. Need for surgical airway.
    - f. Obvious esophageal injury.
    - g. Obvious tracheal injury.
  2. If the platysma has been violated, then classify the wound as:(see picture with frequency)
    - a. Zone I – below cricoid cartilage.
    - b. Zone II – between cricoid and angle of the mandible.
    - c. Zone III – above the angle of the mandible.
    - d. An X-ray of the neck may be helpful if a bullet or foreign body is still in the neck



3. For STABLE Zone I injuries (which are really chest injuries):
  - a. Obtain a chest X-ray to determine the presence of chest injury.
    - i. Obtain an angiogram or CTA, including the aortic arch and the great vessels.
    - ii. Obtain an esophagram. (Gastrograffin and if no defined leak proceed to thin barium for better definition)
    - iii. Obtain or perform bronchoscopy.
  - b. Obtain CT scan to determine track of bullet
  - c. If track approaches vessels or airway, then will need an angiogram and bronchoscopy
  - d. Treat on the basis of the findings.
  
4. For a Zone II injury, use clinical findings to classify as low probability of vascular and aerodigestive injury or high probability of vascular and aerodigestive injury.
  - a. For high probability injuries (GSW, shotgun wounds, swelling, path crossing midline):
    - i. If the injury is a gunshot wound or a shotgun injury, consider a CT angiogram to help define extent and location of vascular injury if the patient is stable. In many cases this step is skipped since vascular injury is likely.
    - ii. Prophylaxis with antibiotics.
    - iii. Take to the operating room for neck exploration.

- b. For low probability injuries (stab wounds, minimal swelling, lateral, posterior). Obtain CTA scan and look for injuries to vital structures. If found and obvious then explore, otherwise:
    - i. Obtain esophagram or EGD.
    - ii. Perform laryngoscopy and bronchoscopy if indicated (e.g., air in tissues or subcutaneous emphysema).
    - iii. Treat based on the findings.
5. For Stable Zone III injuries:
- a. Obtain angiogram.
  - b. Obtain or perform direct pharyngoscopy, laryngoscopy if injury suspected.
  - c. Treat based on findings.

Adopted WEST trauma guidelines

Sperry & Et al. . Western Trauma Association Critical Decisions in Trauma: Penetrating neck trauma. *Journal of Trauma and Acute Care Surgery* Volume 75, Number 6 2013

## References

1. Bumpous JM, Whitt PD, Ganzel TM, et al. Penetrating injuries of the visceral compartment of the neck. *Am J Otolaryngol*. 2000;21:190-194.
2. Atta HM. Organ injury scaling system can be used to predict length of stay in patients with penetrating neck injuries. *Am Surg*. 1999;65:575-577.
3. Bladergroen M, Brockman R, Luna G, et al. A twelve-year survey of cervicothoracic vascular injuries. *Am J Surg*. 1989;157:483-486.
4. Amirjamshidi A, Abbassioun K, Rahmat H. Traumatic aneurysms and arteriovenous fistulas of the extracranial vessels in war injuries. *Surg Neurol*. 2000;53:136-145.
5. Fogelman M, Stewart R. Penetrating wounds of the neck. *Am J Surg*. 1956;91:581-596.
6. Markey JC Jr, Hines JL, Nance FC. Penetrating neck wounds: a review of 218 cases. *Am Surg*. 1975;41:77-83.
7. Merion RM, Harness JK, Ramsburgh SR, et al. Selective management of penetrating neck trauma. Cost implications. *Arch Surg*. 1981;116:691-696.
8. Almskog BA, Angeras U, Hall-Angeras M, et al. Penetrating wounds of the neck. Experience from a Swedish hospital. *Acta Chir Scand*. 1985;151:419-423.
9. Roon AJ, Christensen N. Evaluation and treatment of penetrating cervical injuries. *J Trauma*. 1979;19:391-397.
10. Walsh MS. The management of penetrating injuries of the anterior triangle of the neck. *Injury*. 1994;25:393-395.
11. Saletta JD, Lowe RJ, Lim LT, et al. Penetrating trauma of the neck. *J Trauma*. 1976;16:579-587.
12. Elerding SC, Manart FD, Moore EE. A reappraisal of penetrating neck injury management. *J Trauma*. 1980;20:695-697.
13. Bishara RA, Pasch AR, Douglas DD, et al. The necessity of mandatory exploration of penetrating zone II neck injuries. *Surgery*. 1986;100:655-660.
14. May M, Chadaratana P, West JW, et al. Penetrating neck wounds: selective exploration. *Laryngoscope*. 1975;85:57-75.
15. Bostwick J III, Schneider WJ, Jurkiewicz MJ, et al. Penetrating injuries of the face and neck. *South Med J*. 1976;69:550-553.
16. Blass DC, James EC, Reed RJ III, et al. Penetrating wounds of the neck and upper thorax. *J Trauma*. 1978;18:2-7.

17. Lundy LJ Jr, Mandal AK, Lou MA, et al. Experience in selective operations in the management of penetrating wounds of the neck. *Surg Gynecol Obstet.* 1978;147:845-848.
18. Meinke AH, Bivins BA, Sachatello CR. Selective management of gunshot wounds to the neck. Report of a series and review of the literature. *Am J Surg.* 1979;138:314-319.
19. Campbell FC, Robbs JV. Penetrating injuries of the neck: a prospective study of 108 patients. *Br J Surg.* 1980;67:582-586.
20. Pate JW, Casini M. Penetrating wounds of the neck: explore or not? *Am Surg.* 1980;46:38-43.
21. Massac E Jr, Siram SM, Leffall LD Jr. Penetrating neck wounds. *Am J Surg.* 1983;145:263-265.
22. Shuck JM, Gregory J, Edwards WS. Selective management of penetrating neck wounds. *Ann Emerg Med.* 1983;12:159-161.
23. Rao PM, Bhatti MF, Gaudino J, et al. Penetrating injuries of the neck: criteria for exploration. *J Trauma.* 1983;23:47-49.
24. Demetriades D, Stewart M. Penetrating injuries of the neck. *Ann R Coll Surg Engl.* 1985;67:71-74.
25. Cohen ES, Breaux CW, Johnson PN, et al. Penetrating neck injuries: experience with selective exploration. *South Med J.* 1987;80:26-28.
26. Ramadan HH, Samara MA, Hamdan US, et al. Penetrating neck injuries during the Lebanese war: AUBMC experience. American University of Beirut Medical Center. *Laryngoscope.* 1987;97:975-977.
27. Mansour MA, Moore EE, Moore FA, et al. Validating the selective management of penetrating neck wounds. *Am J Surg.* 1991;162:517-520; discussion, 520-521.
28. Roden DM, Pomerantz RA. Penetrating injuries to the neck: a safe, selective approach to management. *Am Surg.* 1993;59:750-753.
29. Luntz M, Nusem S, Kronenberg J. Management of penetrating wounds of the neck. *Eur Arch Otorhinolaryngol.* 1993;250:369-374.
30. Sofianos C, Degiannis E, Van den Aardweg MS, et al. Selective surgical management of zone II gunshot injuries of the neck: a prospective study. *Surgery.* 1996;120:785-788.
31. Klyachkin ML, Rohmiller M, Charash WE, et al. Penetrating injuries of the neck: selective management evolving. *Am Surg.* 1997;63:189-194.
32. Hersman G, Barker P, Bowley DM, et al. The management of penetrating neck injuries. *Int Surg.* 2001;86:82-89.
33. Sheely CH II, Mattox KL, Reul GJ Jr, et al. Current concepts in the management of penetrating neck trauma. *J Trauma.* 1975;15:895-900.
34. Ayuyao AM, Kaledzi YL, Parsa MH, et al. Penetrating neck wounds. Mandatory versus selective exploration. *Ann Surg.* 1985;202:563-567.
35. Stroud WH, Yarbrough DR III. Penetrating neck wounds. *Am J Surg.* 1980;140:323-326.
36. Jurkovich GJ, Zingarelli W, Wallace J, et al. Penetrating neck trauma: diagnostic studies in the asymptomatic patient. *J Trauma.* 1985;25:819-822.
37. Ordog GJ, Albin D, Wasserberger J, et al. 110 bullet wounds to the neck. *J Trauma.* 1985;25:238-246.
38. Cabasares HV. Selective surgical management of penetrating neck trauma. 15-year experience in a community hospital. *Am Surg.* 1982;48:355-358.
39. Goldberg PA, Knottenbelt JD, van der Spuy JW. Penetrating neck wounds: is evidence of chest injury an indication for exploration? *Injury.* 1991;22:7-8.
40. Meyer JP, Barrett JA, Schuler JJ, et al. Mandatory vs selective exploration for penetrating neck trauma. A prospective assessment. *Arch Surg.* 1987;122:592-597.
41. Biffi WL, Moore EE, Rehse DH, et al. Selective management of penetrating neck trauma based on cervical level of injury. *Am J Surg.* 1997;174:678-682.
42. Sriussadaporn S, Pak-Art R, Tharavej C, et al. Selective management of penetrating neck injuries based on clinical presentations is safe and practical. *Int Surg.* 2001;86:90-93.
43. Nason RW, Assuras GN, Gray PR, et al. Penetrating neck injuries: analysis of experience from a Canadian trauma centre. *Can J Surg.* 2001;44:122-126.
44. Narrod JA, Moore EE. Initial management of penetrating neck wounds-a selective approach. *J Emerg Med.* 1984;2:17-22.
45. Narrod JA, Moore EE. Selective management of penetrating neck injuries. A prospective study. *Arch Surg.* 1984;119:574-578.
46. Velmahos GC, Souter I, Degiannis E, et al. Selective surgical management in penetrating neck injuries. *Can J Surg.* 1994;37:487-491.

47. Golueke PJ, Goldstein AS, Sclafani SJ, et al. Routine versus selective exploration of penetrating neck injuries: a randomized prospective study. *J Trauma*. 1984;24:1010-1014.
48. Atta HM, Walker ML. Penetrating neck trauma: lack of universal reporting guidelines. *Am Surg*. 1998;64:222-225.
49. Hirshberg A, Wall MJ, Johnston RH Jr, et al. Transcervical gunshot injuries. *Am J Surg*. 1994;167:309-312.
50. Demetriades D, Theodorou D, Cornwell E, et al. Transcervical gunshot injuries: mandatory operation is not necessary. *J Trauma*. 1996;40:758-760.
51. Gracias VH, Reilly PM, Philpott J, et al. Computed tomography in the evaluation of penetrating neck trauma: a preliminary study. *Arch Surg*. 2001;136:1231-1235.
52. Mazolewski PJ, Curry JD, Browder T, et al. Computed tomographic scan can be used for surgical decision making in zone II penetrating neck injuries. *J Trauma*. 2001;51:315-319.
53. Munera F, Soto JA, Nunez D. Penetrating injuries of the neck and the increasing role of CTA. *Emerg Radiol*. 2004;10:303-309.
54. Nunez DB Jr, Torres-Leon M, Munera F. Vascular injuries of the neck and thoracic inlet: helical CT-angiographic correlation. *Radiographics*. 2004;24:1087-1098.
55. Inaba K, Munera F, McKenney M, et al. Prospective evaluation of screening multislice helical computed tomographic angiography in the initial evaluation of penetrating neck injuries. *J Trauma*. 2006;61:144-149.
56. Woo K, Magner DP, Wilson MT, et al. CT angiography in penetrating neck trauma reduces the need for operative neck exploration. *Am Surg*. 2005;71:754-758.
57. Bell RB, Osborn T, Dierks EJ, et al. Management of penetrating neck injuries: a new paradigm for civilian trauma. *J Oral Maxillofac Surg*. 2007;65:691-705.
58. Prgomet D, Danic D, Milicic D, et al. Management of war-related neck injuries during the war in Croatia, 1991-1992. *Eur Arch Otorhinolaryngol*. 1996;253:294-296.
59. Danic D, Prgomet D, Milicic D, et al. War injuries to the head and neck. *Mil Med*. 1998;163:117-119.
60. Cooper A, Barlow B, Niemirska M, et al. Fifteen years' experience with penetrating trauma to the head and neck in children. *J Pediatr Surg*. 1987;22:24-27.
61. Hall JR, Reyes HM, Meller JL. Penetrating zone-II neck injuries in children. *J Trauma*. 1991;31:1614-1617.
62. Thomas AN, Goodman PC, Roon AJ. Role of angiography in cervicothoracic trauma. *J Thorac Cardiovasc Surg*. 1978;76:633-638.
63. O'Donnell VA, Atik M, Pick RA. Evaluation and management of penetrating wounds of the neck: the role of emergency angiography. *Am J Surg*. 1979;138:309-313.
64. Smith RF, Elliot JP, Hageman JH, et al. Acute penetrating arterial injuries of the neck and limbs. *Arch Surg*. 1974;109:198-205.
65. Dunbar LL, Adkins RB, Waterhouse G. Penetrating injuries to the neck. Selective management. *Am Surg*. 1984;50:198-204.
66. Hiatt JR, Busuttill RW, Wilson SE. Impact of routine arteriography on management of penetrating neck injuries. *J Vasc Surg*. 1984;1:860-866.
67. North CM, Ahmadi J, Segall HD, et al. Penetrating vascular injuries of the face and neck: clinical and angiographic correlation. *AJR Am J Roentgenol*. 1986;147:995-999.
68. Hartling RP, McGahan JP, Lindfors KK, et al. Stab wounds to the neck: role of angiography. *Radiology*. 1989;172:79-82.
69. Rivers SP, Patel Y, Delany HM, et al. Limited role of arteriography in penetrating neck trauma. *J Vasc Surg*. 1988;8:112-116.
70. Noyes LD, McSwain NE Jr, Markowitz IP. Panendoscopy with arteriography versus mandatory exploration of penetrating wounds of the neck. *Ann Surg*. 1986;204:21-31.
71. Sclafani SJ, Cavaliere G, Atweh N, et al. The role of angiography in penetrating neck trauma. *J Trauma*. 1991;31:557-562.
72. Menawat SS, Dennis JW, Laneve LM, et al. Are arteriograms necessary in penetrating zone II neck injuries? *J Vasc Surg*. 1992;16:397-400.
73. Nemzek WR, Hecht ST, Donald PJ, et al. Prediction of major vascular injury in patients with gunshot wounds to the neck. *AJNR Am J Neuroradiol*. 1996;17:161-167.
74. Jarvik JG, Philips GR III, Schwab CW, et al. Penetrating neck trauma: sensitivity of clinical examination and cost-effectiveness of angiography. *AJNR Am J Neuroradiol*. 1995;16:647-654.
75. Demetriades D, Theodorou D, Cornwell E III, et al. Penetrating injuries of the neck in patients in stable condition. Physical examination, angiography, or color flow Doppler imaging. *Arch Surg*. 1995;130:971-975.

76. Demetriades D, Theodorou D, Cornwell E, et al. Evaluation of penetrating injuries of the neck: prospective study of 223 patients. *World J Surg.* 1997;21:41-47; discussion, 47-48.
77. Bynoe RP, Miles WS, Bell RM, et al. Noninvasive diagnosis of vascular trauma by duplex ultrasonography. *J Vasc Surg.* 1991;14:346-352.
78. Montalvo BM, LeBlang SD, Nunez DB Jr, et al. Color Doppler sonography in penetrating injuries of the neck. *AJNR Am J Neuroradiol.* 1996;17:943-951.
79. Ginzburg E, Montalvo B, LeBlang S, et al. The use of duplex ultrasonography in penetrating neck trauma. *Arch Surg.* 1996;131:691-693.
80. Corr P, Abdool Carrim AT, Robbs J. Colour-flow ultrasound in the detection of penetrating vascular injuries of the neck. *S Afr Med J.* 1999;89:644-646.
81. Munera F, Soto JA, Palacio D, et al. Diagnosis of arterial injuries caused by penetrating trauma to the neck: comparison of helical CT angiography and conventional angiography. *Radiology.* 2000;216:356-362.
82. Munera F, Soto JA, Palacio DM, et al. Penetrating neck injuries: helical CT angiography for initial evaluation. *Radiology.* 2002;224:366-372.
83. Ofer A, Nitecki SS, Braun J, et al. CT angiography of the carotid arteries in trauma to the neck. *Eur J Vasc Endovasc Surg.* 2001;21:401-407.
84. Splener CW, Benfield JR. Esophageal disruption from blunt and penetrating external trauma. *Arch Surg.* 1976;111:663-667.
85. Asensio JA, Berne J, Demetriades D, et al. Penetrating esophageal injuries: time interval of safety for preoperative evaluation-how long is safe? *J Trauma.* 1997;43:319-324.
86. Asensio JA, Chahwan S, Forno W, et al. Penetrating esophageal injuries: multicenter study of the American Association for the Surgery of Trauma. *J Trauma.* 2001;50:289-296.
87. Hatzitheofilou C, Strahlendorf C, Kakoyiannis S, et al. Penetrating external injuries of the oesophagus and pharynx. *Br J Surg.* 1993;80:1147-1149; erratum, 1491.
88. Symbas PN, Hatcher CR Jr, Vlasis SE. Esophageal gunshot injuries. *Ann Surg.* 1980;191:703-707.
89. Cheadle W, Richardson JD. Options in management of trauma to the esophagus. *Surg Gynecol Obstet.* 1982;155:380-384.
90. Shama DM, Odell J. Penetrating neck trauma with tracheal and oesophageal injuries. *Br J Surg.* 1984;71:534-536.
91. Popovsky J. Perforations of the esophagus from gunshot wounds. *J Trauma.* 1984;24:337-339.
92. Armstrong WB, Detar TR, Stanley RB. Diagnosis and management of external penetrating cervical esophageal injuries. *Ann Otol Rhinol Laryngol.* 1994;103:863-871.
93. Stanley RB Jr, Armstrong WB, Fetterman BL, et al. Management of external penetrating injuries into the hypopharyngeal-cervical esophageal funnel. *J Trauma.* 1997;42:675-679.
94. Madiba TE, Muckart DJ. Penetrating injuries to the cervical oesophagus: is routine exploration mandatory? *Ann R Coll Surg Engl.* 2003;85:162-166.
95. Minard G, Kudsk KA, Croce MA, et al. Laryngotracheal trauma. *Am Surg.* 1992;58:181-187.
96. Grewal H, Rao PM, Mukerji S, et al. Management of penetrating laryngotracheal injuries. *Head Neck.* 1995;17:494-502.
97. Weigelt JA, Thal ER, Snyder WH III, et al. Diagnosis of penetrating cervical esophageal injuries. *Am J Surg.* 1987;154:619-622.
98. Wood J, Fabian TC, Mangiante EC. Penetrating neck injuries: recommendations for selective management. *J Trauma.* 1989;29:602-605.
99. Ngakane H, Muckart DJ, Luvuno FM. Penetrating visceral injuries of the neck: results of a conservative management policy. *Br J Surg.* 1990;77:908-910.
100. Srinivasan R, Haywood T, Horwitz B, et al. Role of flexible endoscopy in the evaluation of possible esophageal trauma after penetrating injuries. *Am J Gastroenterol.* 2000;95:1725-1729.
101. McCormick TM, Burch BH. Routine angiographic evaluation of neck and extremity injuries. *J Trauma.* 1979;19:384-387.
102. Metzendorff MT, Lowe DK. Operation or observation for penetrating neck wounds? A retrospective analysis. *Am J Surg.* 1984;147:646-649.
103. Apffelstaedt JP, Muller R. Results of mandatory exploration for penetrating neck trauma. *World J Surg.* 1994;18:917-919; discussion, 920.
104. Demetriades D, Charalambides D, Lakhoo M. Physical examination and selective conservative management in patients with penetrating injuries of the neck. *Br J Surg.* 1993;80:1534-1536.

105. Gerst PH, Sharma SK, Sharma PK. Selective management of penetrating neck trauma. *Am Surg.* 1990;56:553-555.
106. Beitsch P, Weigelt JA, Flynn E, et al. Physical examination and arteriography in patients with penetrating zone II neck wounds. *Arch Surg.* 1994;129:577-581.
107. Atteberry LR, Dennis JW, Menawat SS, et al. Physical examination alone is safe and accurate for evaluation of vascular injuries in penetrating zone II neck trauma. *J Am Coll Surg.* 1994;179:657-662.
108. Sekharan J, Dennis JW, Veldenz HC, et al. Continued experience with physical examination alone for evaluation and management of penetrating zone 2 neck injuries: results of 145 cases. *J Vasc Surg.* 2000;32:483-489.
109. Azuaje RE, Jacobson LE, Glover J, et al. Reliability of physical examination as a predictor of vascular injury after penetrating neck trauma. *Am Surg.* 2003;69:804-807.
110. Mohammed GS, Pillay WR, Barker P, et al. The role of clinical examination in excluding vascular injury in haemodynamically stable patients with gunshot wounds to the neck. A prospective study of 59 patients. *Eur J Vasc Endovasc Surg.* 2004;28:425-430.
111. Goudy SL, Miller FB, Bumpous JM. Neck crepitance: evaluation and management of suspected upper aerodigestive tract injury. *Laryngoscope.* 2002;112:791-795.
112. Gonzalez RP, Falimirski M, Holevar MR, et al. Penetrating zone II neck injury: does dynamic computed tomographic scan contribute to the diagnostic sensitivity of physical examination for surgically significant injury? A prospective blinded study. *J Trauma.* 2003;54:61-64.