Volume: 26, Issue:1, January 2015 pp: 3-5 ORIGINAL ARTICLE / ORJİNAL MAKALE

LENGTH OF THE TRAJECTORY OF ANTERIOR ODONTOID SCREW IN ADULT TURKISH POPULATION: A MORPHOMETRIC STUDY

ERİŞKİN TÜRK TOPLUMUNDA ODONTOİD VİDA UZUNLUĞU: MORFOMETRİK BİR ÇALIŞMA

Uygur ER[1],
İ.Teoman BENLI[2]

[1]MD, Professor of Neurosurgery, Depatment of Neurosurgery Medical School of Düzce University, Düzce.

[2]MD, Professor of Orthopedics and Traumatology, Director of the Department of the Orthopedics and Traumatology, Hisar Intercontinental Hospital, İstanbul.

SUMMARY:

Anterior placement of a screw for fixation of an odontoid fracture is performed to maintain axial rotation at the C1, C2 level. This morphometric study was performed to determine the length of anterior odontoid screw trajectory in adult Turkish population. Measurement of the trajectory length was performed on midsagittal T1-W sequence of MRI. Overall average length is 3.52±0.81 cm. Commonly used 35 mm screws are suitable for approximately half of the population.

Key words: Anterior odontoid screw fixation, Odontoid fractures, Surgery

Level of evidence: Retrospective clinical study, Level III

ÖZET:

C1, C2 düzeyinde yapılacak sabitlemede aksiyal rotasyonu korumak için anterior odontoid vidası kullanılmaktadır. Bu morfometrik çalışma erişkin Türk toplumunda uygun anterior odontoid vidası boyunu belirlemektir. Vida yolu ölçümleri T1-A midsagittal MRG üzerinde yapılmıştır. Vida yolunun ortalama uzunluğu 3.52±0.81 cm. dir. Sıklıkla kullanılan 35 mm. vidalar toplumun yarısı için uygun olduğu belirlenmiştir.

Anahtar sözcükler: Anterior odontoid vidası ile sabitleme, Cerrahi, Odontoid kırığı

Kanıt Düzeyi: Retrospektif klinik çalışma, Düzey III

Address: Uygur ER MD, Professor of Neurosurgery Neurosurgery Dept., Medical School, Duzce University, 81100, Duzce
Tel: 0 505 589 23 55
Fax: 0 380 542 13 87
E-mail: uygurer@gmail.com
Received: 12th October, 2014.
Accepted: 1st December, 2014.

INTRODUCTION:

Fractures of the odontoid process at its junction with the corpus are the commonest odontoid fractures[8]. Anterior placement of a screw for fixation of a type II or narrow type III odontoid fracture is performed to maintain axial rotation at the C1, C2 level[12]. It may also be done in cases of posterior element deficiency in fractures in the upper cervical region. The effective application of these screws requires a preoperative transaxial computed tomography (CT) scan to detect the diameter of odontoid waist, thus determining the number of screws that may be placed safely within it. The favored screws for this intervention are two 3,5 mm cancellous lag screws requiring a minimum of an 8 mm wide odontoid waist[12]. Some studies in the literature have shown that a single screw, with less associated risk may be just as effective as two screws in obtaining a fusion[3]. To facilitate the choice of screws, one should know the length of the trajectory of the screw and prepare appropriate size screw preoperatively. This morphometric study was performed to determine the length of anterior odontoid screw trajectory in adult Turkish population.

MATERIALS AND METHODS:

This study is a retrospectively designed morphometric MRI study.

Patient population

Two hundreds adult patients aged between 18 and 65, consisting 100 women and 100 men were included in the study. Average age of women is 47.5 age, and men is 44.9 age. Overall average age of the population is 46.2 age.

Including criteria

i. Adult male and female patients.
ii. Patients with normal craniovertebral junction (CVJ) by measurement of routine radiograms.

Excluding criteria

i. Patients with abnormal CVJ measurement, platybasia or basilar invagination.
ii. Patients had an upper cervical trauma.
iii. Patients underwent an operation at the CVJ.
iv. Patients with systemic metabolic diseases.
v. Patients with a disseminated bone disease.

Measurement:

Cervical spinal magnetic resonance imaging (MRI) in 200 consecutive adult patients, who were undergoing MRI for an unrelated complaint were analyzed. Measurement of the trajectory length was performed on midsagittal T1-Weighted sequence of MRI (Hitachi Echelon 1.5 T, Hitachi medical Systems America, Inc., USA). The length assessed from anterior odontoid basis to the posterior corner of the odontoid tip (Figure 1) (SarusPACS, DICOM viewer, EES, Ankara, Türkiye).

Sample size representative of a large population was calculated at 95% confidence interval and with a margin of error <0.1.

Figure-1. Midsagittal T1-W MRI shows suggested measurement of odontoid screw trajectory.

RESULTS:

Mean age of the population is 46.2 age with a range between 18 and 65 years. Mean ages of males is 44.9 years, range 20 and 65 years and mean age of females is 47.5 years, range 18 and 65 years. The distribution of age in the two sexes was comparable. Mean trajectory length of odontoid is 3.48±0.79 cm for females, 3.56±0.83 cm for males (Table-1). The range of the length is from 2.69 cm to 4.00 cm for females, and from 2.71 cm to 4.02 cm for males. Overall average length is 3.52±0.81 cm.

DISCUSSION:

Odontoid fractures account for 9-15 % of cervical fractures [6,9]. The commonest fractures of odontoid process are Anderson and D'Alonzo type II fractures[1]. Without compromising C1- C2 motion was considered since the first use of screws for internal fixation of odontoid fractures. Bohler et al (2) and Nakanishi et al[10] have shown comparable union rates between anterior screw fixation and C1- C2 fusion without compromising C1- C2 motion. Two screws fixation was evolved single screw fixation since some authors have shown that there is no significant difference in the strength of

fixation between one and two screws[11]. Subsequent clinical studies also showed comparable union rates between two and one screw fixation[4,5,7]. However, screw breakage is occurred in approximately10% cases, if single screw was performed[7].

Commonly used 3.5 mm lag screws are as long as the mean length of odontoid. In other words they are not suitable for approximately half of the population. A preoperative midsagittal T1-W MRI can help determine the appropriate screw size. A larger sample size and prospectively designed multiparameter studies may help surgeons to use tailored instruments for odontoid fixation to achieve a better union rates.

REFERENCES:

1. Anderson LD, D' Alonzo RT. Fractures of the odontoid process of the axis. *J Bone Joint Surg* 1974; 56-A: 1663–1674.
2. Bohler J. Anterior stabilization for acute fractures and nonunions of the dens. *J Bone Joint Surg* 1982; 62-A: 18–27.
3. Chang KW, Liu YW, Cheng PG, Suen KL, Chung WL, Chen UL, Liang PL. One Herbert double-threaded compression screw fixation of displaced type II odontoid fractures. *J Spin Disord* 1994; 7; 62-69.
4. Esses SI, Bednar DA. Screw fixation of odontoid fractures and nonunions. *Spine* 1991; 16(Suppl 10): S483–485.
5. Feng G, Wendlandt R, Spuck S, Schulz AP. One-screw fixation provides similar stability to that of two-screw fixation for type II dens fractures. *Clin Ortop Relat Res* 2012; 470: 2021-2028.
6. Husby J, Sorensen KH. Fracture of the odontoid process of the axis. *Acta Orthop Scand* 1974; 45: 182-192.
7. Jenkins JD, Coric D, Branch CL. A clinical comparison of one and two screw odontoid fixation. *J Neurosurg* 1998; 89: 366–370.
8. Kulkarni AG, Shah SM, Marvah RA, Hanagandi PB, Talwar IR. CT based evaluation of odontoid morphology in the Indian population. *Indian J Ortop* 2013; 47(3): 250-254.
9. Maak TG, Grauer JN. The contemporary treatment of odontoid injuries. *Spine* 2006; 31(11 Suppl): S53-60.
10. Nakanishi T, Sasaki T, Tokita N, Hirabayashi K. Internal fixation for the odontoid fracture. *Orthop Trans* 1982; 6: 176.
11. Sasso R, Doherty BJ, Crawford MJ, Heggeness MH. Biomechanics of odontoid fracture fixation. *Spine* 1993; 18: 1950–1953.
12. Vaccaro AR, Cotler JM. Upper cervical spine injuries in the adult. In: An S Howard (ed.) *Principles and techniques of spine surgery*. Baltimore, Williams and Wilkins. 1998; pp: 331-358.