Complications of endoscopic sinus surgery

INTRODUCTION:

Endoscopic sinus surgery, a widely used method in the treatment of chronic sinus disease can lead to major (0-1, 5 %) and minor (1, 1-20, 8%) complications. These complications are still important nowadays. Central nervous system (CNS) fistula, hemorrhage, meningitis, orbital injury and even death are major pathologies. These are usually the result of injury of fovea ethmoidalis or orbital structures [1-4]. If the skull base anatomy and its possible variations are well known these risks will be minimized. ‘ Fovea ethmoidalis’ which seperates ethmoid cells from anterior cranial fossa forms the roof of ethmoidal labrynth [5, 6]. Fovea ethmoidalis adheres to lateral lamella of cribriform plate which is a medially located very thin bone [7]. Keros [8] classified the depth of olfactory fossa as the height of lateral lamella in 1962. According to his classification if the height of lateral lamella <3mm this type of olfactory fossa is called Keros type I, 4-7 mm Keros type II, 8-16 mm Keros type III respectively [8]. Type III has the highest risk of iatrogenic injury during surgery [9]. Except these types, a lot of studies discovered that there may be asymetries between two sides of the height of ethmoid roof and the shape of fovea ethmoidalis [10, 11]. For the detection of these variations and learning anatomic details, multidetector computerized tomography (MDCT) must be done before surgery.

MATERIAL-METHOD

Two hundred paranasal sinus computed tomographies performed for various reasons as a total of 400 hemisides of paranasal region were analyzed retrospectively. Patients under 18 years of age, with a history of prior surgery, trauma which led to massive destruction of bones and patients with congenital anomalies were excluded from the study. A hundred of the patients were female (18-77 years old, mean age: 36, 91) and 100 male (18-76 years old, mean age: 34, 25), respectively. MDCT scanner (Siemens Medical Solutions, Enlargen, Germany) with consecutive 1mm thick sections were obtained and coronal multiplanar reconstructions were performed. Bone algorithm was used. In our study , we measured that the depths of olfactory fossa, identifying Keros types, the distances of the ethmoidal roof from hard palate, the distances between upper and lower limits of the orbita bilateraly. The height of ethmoid roof was calculated by measuring the distance between ethmoid roof and the upper limit of orbita. Measurements in coronal sections were performed at the level of the optic nerve just posterior to the orbital globe. Also the shapes of the bone from the confluence of ethmoidal fovea with lateral lamella are called type 1 if its shape looks like a broken arrow (broken wing) and type 2 if its shape is flat (flattening) and forms of the asymmetry were investigated. Keros typing, ethmoid roof height and asymmetric shape of the fovea were investigated in both sexes whether there is a relationship between them. NCSS statistical analysis (Number Cruncher Statistical System) 2007 Statistical Software (Utah, USA) was performed with the package program. Data were evaluated by descriptive statistical methods (mean, standard deviation), as well as comparisons between groups one-way analysis of variance, in the sub-group comparisons Tukey’s multiple comparison test, in the binary comparisons of groups and independent t test, in the qualitative comparisons of data chi-square and weighted kappa compatibility test was used. Results significances were evaluated at p <0. 05 level.

RESULTS:

According to the classification of Keros, 3. 75% of the patients Keros type I (n = 15), 59. 5% Keros type II (n = 238), 36. 75% Keros type III (n = 147). Keros type III is more common in males (n= 86, 43%) than females (n= 61, 30. 5%) (p = 0. 017). The shapes of fovea ethmoidalis in 97. 25% (n = 389) of the patients were the broken arrows (type 1), while 2. 75% (n = 11) of the shapes were flat (type 2) . In 54 cases (13. 5%) an olfactory fossa Keros type asymmetry, in 11 cases (2. 75%) foveal shape asymmetry was found. In seven patients (3. 5%) as well as the foveal shape asymmetry also Keros olfactory fossa type asymmetry was seen . Keros type I patients' orbital maximal height average were measured 33. 07 ± 1. 24 mm, Keros type II patients 32. 57 ± 1. 97 mm, Keros Type III patients 33. 31 ± 2. 11 mm respectively. In the male patients , the average heights of the orbits of Keros III group were significantly higher than Keros group II (p = 0. 034). The olfactory fossa depth was measured at an average 6. 45 ± 2. 16 mm on the right , 6. 39 ± 2. 21 mm on the left. The average depth of the olfactory fossa in males (6. 7 ± 2. 45 mm) was higher than in females (6. 13 ± 1. 84 mm) (p = 0. 01). There was no significant difference between the olfactory fossa depth between type 1 or type 2 foveal shape.

Right and left olfactory fossa depth which were used for detection of Keros typing was compared. In 93 patients (46. 5%) from the total of 200 patients asymmetry was detected. In 55 patients > 1 mm (27. 5%), in 38 patients had > 2 mm (19%) difference was found. Forty-eight of them female and 45 were male. In seven of the same patients showed foveal shape asymmetry also. Average right ethmoid roof height 7. 59 ± 2. 25 mm , average left ethmoid roof height was measured 7. 75 ± 2. 38 mm. In men with type 2 foveal shape the group's average height of the ethmoid roof (9. 59 ± 2. 77 mm) was higher than the foveal shape of type 1 group (7. 66 ± 2. 36 mm) (p = 0. 042). In women, the average height of the ethmoid roof of type 2 group (8. 75 ± 1. 76 mm) was higher than type 1 group (7. 34 ± 2. 11 mm) (p = 0. 03). There was no statistically significant difference was observed between the averages of heights of ethmoid roofs in Keros type I, II and III patients. Right and left ethmoid roof heights were compared in total of 200 patients. There was an asymetry between left and right sides in 93 patients (46. 5%) . In 55 patients > 1 mm difference (27. 5%), in 38 patients had > 2 mm difference (19%) was found. Forty-nine of them were female, 44 of them were male. Five of the same patients showed asymmetry in the shape of the fovea also. In 54 patients (27%), asymmetry was observed in both ethmoid roof height and olfactory fossa depth . Twenty-nine of them were female, twenty-five of them were male. In the same group; the foveal shape in four patients showed asymmetry also. For the Keros type I patients both sides of the olfactory fossa depth asymmetry ratio was found to be more (53, 3%) than the other types. For the same measurement, the ratios were found 40, 8% and 29, 4 % with Keros type II and type III respectively.

Kerosian ethmoid roof height of both sides in patients with type I, asymmetry ratio was found to be greater (40. 0%). For the same measurement, the results were 33. 3% and 29. 4% in Keros type III and type II respectively. In the Keros type I patients foveal shape asymmetry was found to be greater (20. 0%) than the other types . The foveal shape asymetry for Keros type II was 4. 2% and 4. 08% for Keros type III respectively. DISCUSSION:

The ethmoid sinuses have special importance especially in patients undergoing sinus surgery . Because these sinuses are close to vital organs such as the anterior cranial fossa, dura, orbita, optic nerve and anterior ethmoid artery [12, 13]. During endoscopic sinus surgery, the maximum likelihood of injury of the skull base is in Keros type III cases in which olfactory fossa are deep [9]. In 1962, in Keros' study with 450 patients, type II patients at a rate of 70. 16% (which was the most common type in that study), type III 18. 25% and type I 11. 59% of the patients [8]. In our study 3. 75% of the patients were Keros type I (Figure 1), 59. 5% of the patients were Keros type II (Figure 2), 36. 75% of the patients were Keros type III (Figure 3) .

After the point of the junction of fovea ethmoidalis with cribriform plate as well as the depth; the shape and symmetry of these structures are also important . In our study, in 93 patients (46. 5%), olfactory fossa height asymmetry was detected and in another 93 patients (46. 5%) foveal shape asymmetry was found. In 54 cases with height asymmetry there was also shape asymmetry (27%). In a study made by Basak et al. [14] in Turkey on 64 children with Keros type I, type II and type III incidences were explained in the following way; 9%, 53% and 38% . Anderhub et al. [15] researched 272 cases of German children for the analysis of cases of ethmoid roof . The results of their study were as follows: 14. 2% of the patients Keros type 1, 70. 6% of the patients Keros type II, 15. 2% of the patients Keros type III . In Jang and his collegues study [16], on 205 adult patients, type II was the most common (69, 5%). In Alazzaw and his collegues study [17] on 150 patients with 3 separate ethnic group type I 80%, type II 20% and type III 0% of the patients were detected. In a study made by Elwany and et al. [18] on 300 Egyptian 42, 5% of type I, 56, 8% type II and 1, 4% type III were found respectively. In this study, the type II olfactory fossa was the commonest type in men (66. 7%), while the type I fossa was commonest in women (53%). In a study made by Souza et al. [19] on 200 Brazilian with type I 26, 3%, type II 73, 3% and type III, 0, 5% of reported cases. Solares et al. [20] in United States examined 50 cases, 83% of the cases type I, 15% type II and %2 type III respectively. In a study in Turkey Erdem et al. [21] showed 8, 1% in 136 patients with type 1, 59, 6% type II, 32, 3% type III; Sahin et al. [22] in 100 cases detected 10% of the patients type I, 61% type II, 29% type III. Dr. Satish Nair [23], found that 77, 2% of type II in the study, 17, 2% of type I and 5, 6%. of type III 5, 6% respectively. As seen in the studies, differences are observed between different countries.

In a study by Lebowitz et al. [24] 200 paranasal tomographies were interpreted. In 86 of the cases, olfactory fossa shapes were symmetric and their heights were the same. Ninety-six cases had shape asymmetry, 19 cases had height asymmetry in olfactory fossa, one case had both shape and height asymmetry. In a study made by Dessi et al. [11] on 150 Italian patients, 10% identified asymmetry of the height of the olfactory fossa. In Fan and et al. [25] studies' on 160 Chinese patients, 15, 6% of cases showed olfactory fossa height asymmetry, 38, 75% of cases had foveal shape asymmetry. Souza et al. [19] showed ethmoid roof height asymmetry in 12% of the cases, contour asymmetry in 48, 5% of the cases. Michael Reiss et al. [26] studied 644 patients, of which 31 % was detected height asymmetry. Kizilkaya et al. [2] reported that in 37, 95% patients was detected height asymmetry. Dr. Satish Nair [23] identified height asymmetry in 11, 7% of the cases. In the same study, ethmoid roof height and contour asymmetry was found in patients at the highest rate with type I (67, 8%); than 32, 3% and 40% with type II and type III followed. In a study made by Kaplanoglu et al. [27] on 500 patients ; in 80% of cases was found height asymmetry, the foveal shape asymmetry was detected in 35% of the patients in the same study. Our current study in patients with Keros type I both olfactory fossa depth and height of the ethmoid roof asymmetries had greater percentage. But in our population Keros type I is less seen. However, most of the skull base injuries were seen in Keros type III cases at a prevalance of 36, 75% in our study in which olfactory fossa depth and height of the ethmoid roof asymmetry rates were quite high (respectively 40, 8%, 33, 3%). Preoperative computed tomography must be interpreted in detail. Especially Keros typing must be done and all the variations should be evaluated carefully.

CONCLUSION

In patients undergoing endoscopic sinus surgery; knowledge of anatomic details and average lengths of skull base and their neighbouring structures and the possible variations of anatomical structures are very important for the prevention of complications that may occur during the operation. Therefore, the preoperative evaluation of paranasal sinus CT by considering the various possibilities is necessary and inevitable.

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