Head and neck cancers are often located near an important anatomical structure such as the spinal cord, brain stem, etc., making the treatment difficult. The primary method of treating head and neck tumors is surgery, often combined with pre- or postoperative radiotherapy. Patients have been irradiated approximately 30 fractions, depending on the dosage. The correct patient position during radiotherapy is crucial for its effectiveness. During the reconstruction of the patient's position, the spine tends to some rotation in the cervicothoracic section in relation to the reference CT. These studies focused on head and neck cancers, particularly the doses absorbed in the canal and spinal cord. This research aimed to check whether the stabilization and verification of the patient's position are sufficient to make a treatment plan correctly and safely during radiotherapy. It has been assessed by comparing the dose distribution in the spinal canal calculated in the TPS Treatment Planning System based on CT and the distribution of the dose delivered during the treatment and calculated based on the CT-CBCT fusion.

RESULTS AND DISCUSSION
Based on DVH, the doses received by the entire spinal canal were determined, as well as the maximum values of fractional doses of 0.5 cm3 and 1 cm3 of his volumes. Based on all collected fractions, the ratio between the estimated fractional dose was calculated based on CBCT images (dCBCT) and the planned fractional dose based on CT (dCT). The obtained results are presented in Fig. 3. DCT was the maximum point dose in the spinal canal in the original treatment plan. DCBCT was obtained by summing up the maximum doses delivered by each fraction. The doses' standard deviation and their absolute and relative differences were calculated for each patient. The p-value of the Student’s t-test for the single sample and the population was obtained. The calculated dose distributions are presented in Fig. 4. The percentage difference between the total doses of DCBCT and the planned dose of DCT ranges from -3.14% to 26.01%, reaching the maximum dose decrease by 1.74 Gy and the maximum increase by 5.92 Gy at the end of radiotherapy treatment. The Student’s t-test with a significance level of 5% shows that in 43% of patients, the differences between DCT and DCBCT were not statistically significant. At the same time, based on the same parameter, 17 patients were not irradiated as scheduled. In eight of them, the maximum dose exceeds 45 Gy, but in these patients, a difference (DCBCT - DCT) < 10 Gy. It is different for another nine of them (DCBCT - DCT< 1 Gy throughout treatment. However, for the entire study group, as a result of the Student’s t-test, we obtain a value of p = 0.76, which proves that there are no statistically significant differences between the doses and allows (based on the maximum point doses) to define the therapy as a therapy carried out correctly. The mean values obtained for the entire study group are below 45 Gy. The mean of relative difference dose value does not exceed 0.5 Gy, which corresponds 1.8% relative value the difference to the mean DCT. The mean and DCBCT values of 43.29 Gy and 42.86 Gy, respectively, do not indicate a risk of spinal cord injury. Each dose over 45 Gy in the canal (Fig. 5A) poses a potential risk of damage to the spinal cord. The data presented in Fig. 5B, confirm that the most significant differences, changes in point doses indicate the local nature of the variability of the patient's position. After drawing the spinal cord on each CT and reading the dose planned for it, and adding the corresponding percentage difference calculated for the spinal canal, the doses delivered to the spinal cord were estimated. The obtained values are shown in Fig. 5C. The uncertainties marked in the picture show the percentage differences between the CT and CBCT doses. None of the patients achieved a dose greater than 45 Gy in the spinal cord.

CONCLUSION
Preliminary verification of the correctness of the treatment were performed correctly. The maximum doses in the volumes of 0.5 cm3 and 1 cm3 showed less variability. Despite the positioning errors and dose differences, the spinal cord was not at risk in any patient. There was no close correlation between the dose change value and the value of the translation or rotation vectors. However, a concentration of positioning errors was observed. These shifts may be partly related to the tilting of the head back and the bending of the neck towards the radiation source. The lack of correlation suggests the presence of additional factors, such as muscle tension, weight loss, or random errors. Particular attention should be paid to the ability of the patient to maintain the appropriate position throughout the duration of the fractional dose.