

Significance of MRI in diagnostics, outcome prognosis and definition the therapeutic tactics for cases of aseptic necrosis of the femoral head

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1. Purpose

Avascular necrosis of the femoral head is a widespread pathologic process in the hip joint, leading to the decrease quality of life. Every year approximately 11000 new cases of the disease are being registered. The most susceptible age group is 35-55 y.o. persons. In 40-50% of all the cases patients are admitted for a medical consultation with an advanced stage of a disease, which increases the risk of forming secondary arthrosis.

2. Material and Methods

MRI data sets of forty two patients were analyzed (28 males and 14 females, mean age – 42.3 y.o.) in cases of aseptic femoral head necrosis. Image processing softwares were OsiriX and MultiVox DICOM Viewer. Parameters analyzed – the volume and the surface of necrosis area comparing to the total volume and surface of the femoral head (Figure 1,2,3).

figure_1.jpg

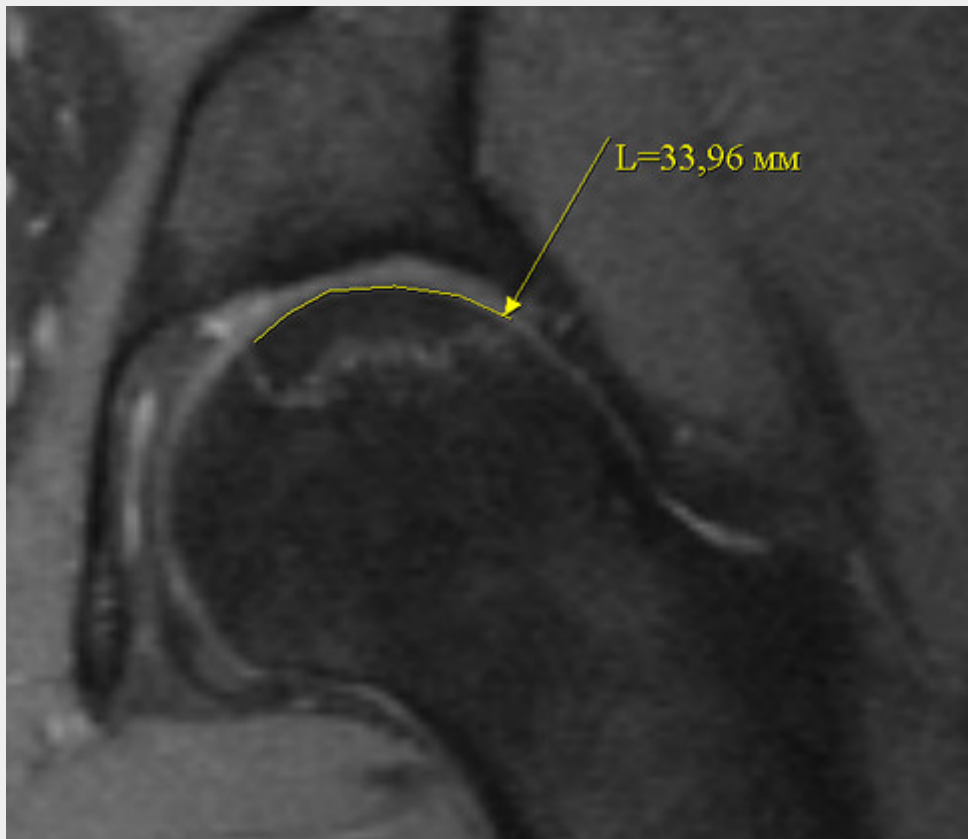


Figure 1 Method of measuring of total surface of necrosis area. Coronal PD fat-saturated image of the hip in a young patient demonstrates the necrotic segment in weight-bearing area of the left femoral head. The length of necrotic bone was outlined manually on the each image (arrow). For the calculation of volume of the necrosis area formula for volume of irregular trapezoid was used: $area = 1/2 * (a_1 + a_2 + \dots + a_n) * h$ (where a_1, a_2, \dots, a_n are the length of necrotic bone on the each image respectively and h is the combination of the slice thickness and slice gap (if any)).

figure_2.tif

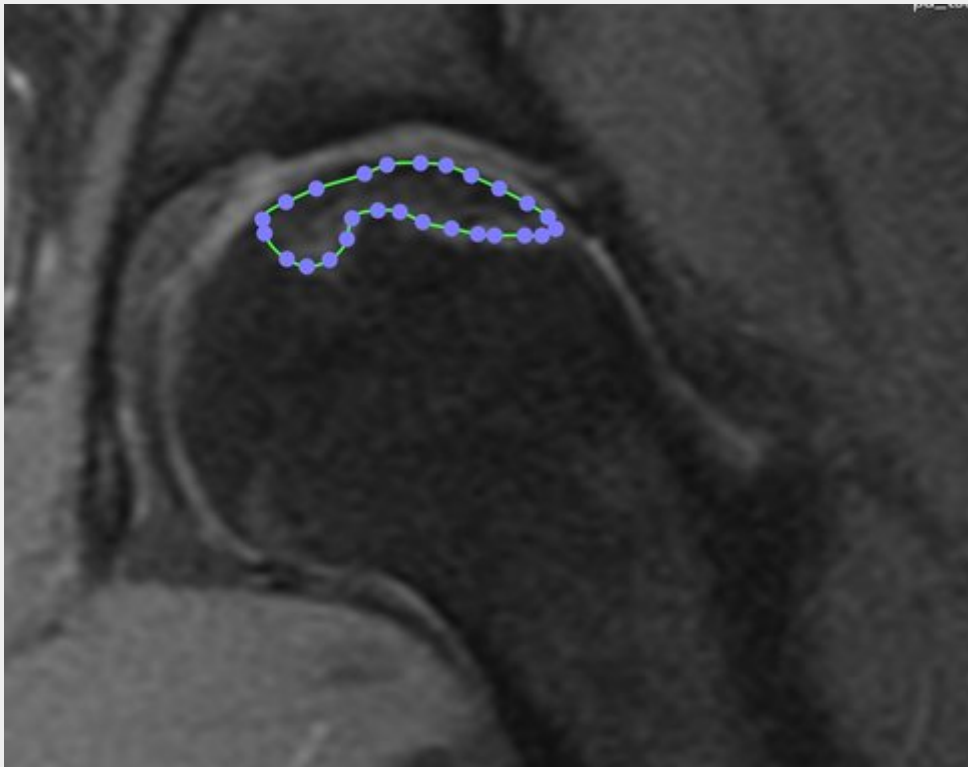


Figure 2 Method of measuring of total volume of necrosis area in the same patient. The area of necrotic bone was outlined manually on the each image (arrow). For the calculation of volume of the necrosis area formula for volume of 3D trapezium was used: $\text{volume} = 1/2 * (b_1 + b_2 + \dots + b_n) * h$ (where b_1, b_2, \dots, b_n are the areas of necrotic bone on the each image respectively and h is the combination of the slice thickness and slice gap (if any)).

figure_3.tif

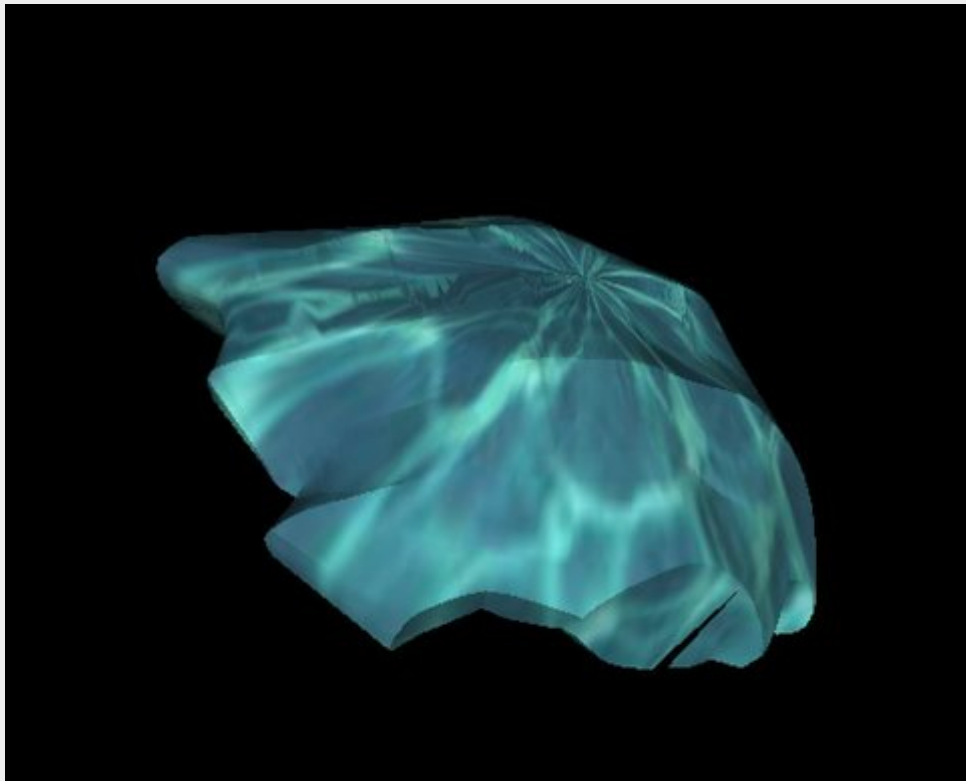


Figure 3 Three-dimensional (3D) model of the necrotic segment reconstructed from MR images.

The MRI-scanning was performed using 1.5 T MRI-scanner. A standardized MRI protocol was used for all examinations. The following sequences were obtained: axial and coronal proton density-weighted fast spin-echo sequence with fat saturation, coronal T1-weighted spin-echo sequence, axial T2-weighted spin-echo sequence.

3. Results

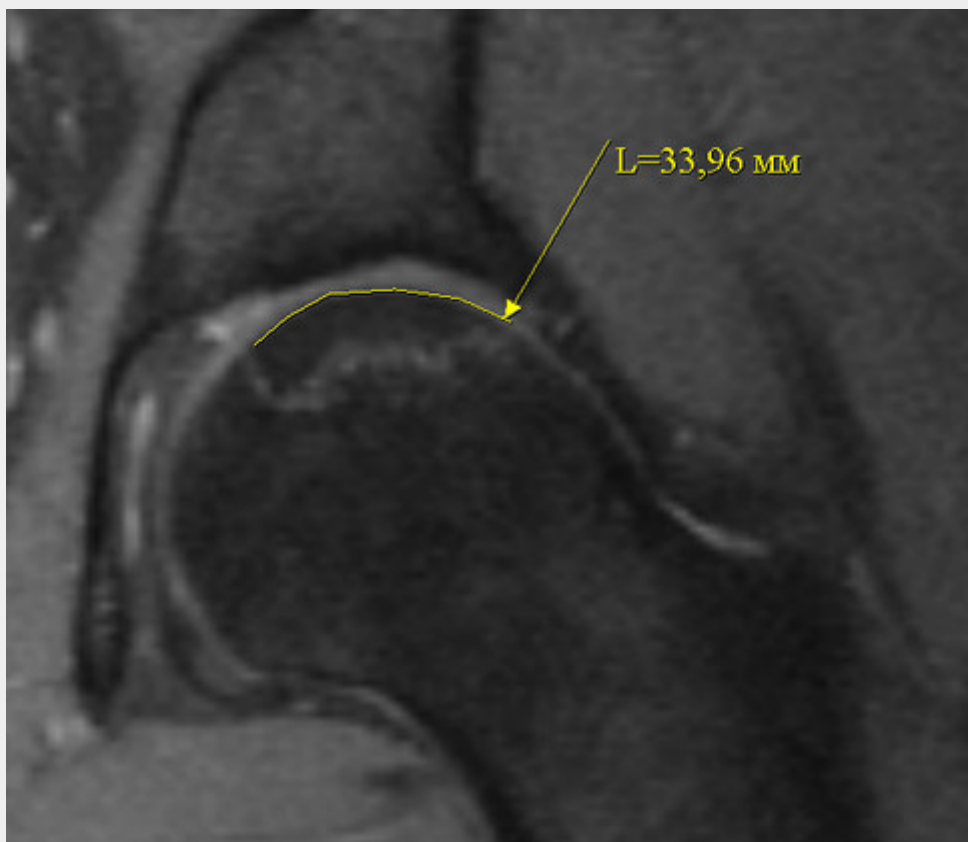
he MRI-scanning allowed defining the necrotic phase of the pathologic process in 20 patients (47.6%), fragmentation phase was detected in 22 patients (52.4%). For the necrotic phase the specific feature was that the necrotic surface/total femoral head surface ratio was approximately 6%. The same parameter in the second group of patients was 25-30%. The differences were statistically significant: $p < 0.001$, $F = 2.5$. The correlation between the risk of the compression fracture and the volume of the osteonecrosis was less significant.

4. Conclusion

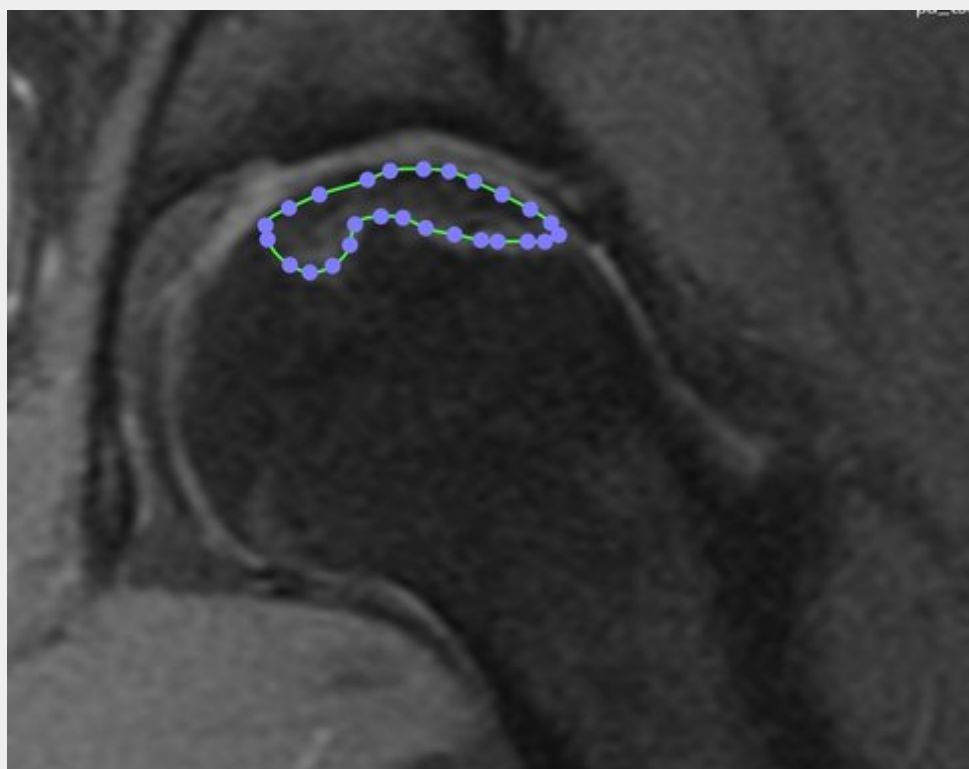
A ratio of the surface area of the necrotic lesion help defining the risk of developing a compression fracture within the osteonecrosis zone, which can influence the disease prognosis and treatment tactics.

5. Mediafiles

figure_1.jpg



figure_2.tif



figure_3.tif

