



ORIGINAL ARTICLE

doi:10.18575/msrs.sm.e.16.03
UDC:616-006.3
COBISS.RS-ID: 5701656

Correlation of Topographic Localization and Clinical Manifestation for Indications for Surgical Treatment of Osteochondroma

Slaviša Kunarac,¹
Jela Aćimović,²
Marinko Domuzin,¹
Milorad Maran,¹
Slaviša Mihajlović²

¹Clinic for Traumatology UMC
Banja Luka

²Public Health Institute of the
Republic of Srpska, Banja Luka

³Health Institute, Drvar

³Health Institute, Drvar

Contact address:

Kunarac Slaviša
Gundulićeva street No. 88
78000 Banja Luka
Republic of Srpska
Mobile: +38765991216
E-mail: slavisa.kunarac@yahoo.com

ABSTRACT

Introduction. Osteochondroma is the most common type of benign bone tumor which appears in two forms, sessile and pedunculated. It accounts for 50% of all benign tumors of bone tissue with a double tendency towards male population. It is covered by cartilage cap of different thickness. The thickness of the cap over 30 mm can indicate a malign transformation into the secondary chondrosarcoma.

Aim of the study. Determine if there is a correlation between epidemic characteristics of the patients, pathohistologic characteristics, thickness of the cartilage cap and biological behavior of the tumor.

Patients and methods. Cross-sectional study included 37 patients which were diagnosed with osteochondroma in the period of 12 months, during the year 2014, at the Institute for pathology of Medical Faculty in Belgrade. The patients' age, sex, localization, clinical manifestation and length of the case history were descriptively determined. The thickness of the cartilage cap was morphometrically determined on pathohistologic devices of re-sectioned tumors. Out of 37 patients with diagnosed osteochondroma, 3 of them (8%) had malign alteration of the cartilage cap. The thickness of the cartilage cap in all the 3 of them was over 30 mm, ranging from 68-120 mm. Relapse was found in 3 patients (8%).

Discussion. The highest importance of this lesion comes from the fact that it is the most common bone tumor with high incidence and possibility for malign transformation of the cartilage cap into secondary chondrosarcoma which makes this tumor interesting for medical staff at the clinic and pathologists.

Conclusion. The width of a cartilage cap, in correlation with clinical and radiology parameters, is a significant predictive parameter of biological behavior of osteochondroma.

Key words. osteochondroma, thickness of the cartilage cap, malign alteration.

(*Scr Med* 2016;47:16-20)

Submitted: November 4th, 2015
Accepted: December 17th, 2015

Introduction

Based on their biological behavior, tumors can be divided into malign and benign tumors. Tumors of the bone system in the highest percentage belong to benign tumors of which the most common tumors are osteochondroma tumors (exostosis), enchondroma, non-ossifying fibroma, giant-cell tumors, Chondromyxoid fibroma, and tumors of bone origin osteblastoma, osteoid osteoma.¹

Patients with this type of tumor are mainly at younger age groups which additionally draws the attention to a delicate approach in dealing with this type of pathology.²

The basic diagnostic principles of all benign bone neoplasm are similar and mean physical clinical examination, less invasive imaging methods if necessary, and biopsy of the suspected bone neoplasm. Indications for surgical treatment of the benign bone tumors are, at the first place, pain and damaged function of the given segment of the locomotor system, followed by swelling and compressive syndrome onto the adjoining neurovascular components.³

The types of surgical interventions for benign cartilage neoplasms are different - from intra-lesion interventions and en-bloc resections to ample resections of the bones which require use of auto and allograft in order to reconstruct the cartilage defect.⁴

Aim of the study

Determine if there is a correlation between epidemic characteristics of the patients, pathohistologic characteristics of the tumor, thickness of the cartilage cap and biological behavior.

Patients and methods

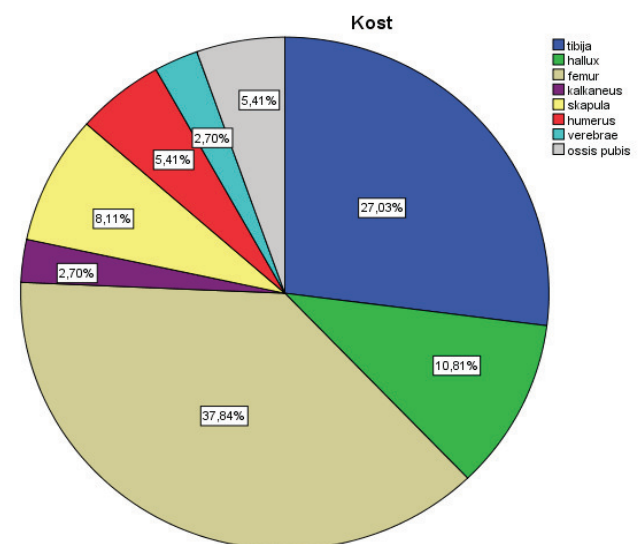
Cross-sectional study included 37 patients which were diagnosed with osteochondroma in the period of 12 months, during the year 2014, at the Institute for pathology of Medical Faculty in Belgrade. The patients' age, sex, localization, clinical manifestations and length of the case history were descriptively determined.

Tumor tissue taken from the radical excision resection was analyzed by microscope, and representative cut sections of the tumor were taken for pathohistologic analysis of the tissue. The tissue was decalcified by the method of fast calcification, using HCl and H₂SO₄. Morphometric analysis of the cartilage cap thickness was done at the smallest magnification (40x) with micrometer scale. The cartilage cap is measured on the width which practically suited the maximum thickness of the chondral component.

The study included 37 patients who were diagnosed with osteochondroma. The average age was 25±16 years. Out of

the total number, there were 24 men (65%) and 13 women (35%). All the patients who were included in the study were divided into 5 intervals of age, in the range from 0-100. After this division, it was determined that most of the patients belong to the first interval from 0-20 years of age, even 54%. The most common localization of the tumor in patients in our study is femur, followed by tibia and scapula. Rare localizations are os pubis and calcaneus. Depending on the type of the bone contexture, 5% of osteochondroma were in the flat and 95% in the long bones. After the whole sample of the patients was divided into children and adults, with 18 years of age being a limit, it was found out that osteochondroma was more common in the long bones of children (89%), while lesion in flat bones was more common in the bones of adults (15%). Lesions on long bones were always localized in metaphysis. (Graph 1.)

Graph 1. Localization of osteochondroma



Clinical manifestations that were included by this research were pain and compression. Basic clinical symptom was pain, present in 36/37 patients, while only 1/37 did not have pain in anamnestic data. Compression syndrome was described in 75% of the patients.

The length of the anamnesis was in the range from minimal 2 to maximal 108 months, while the average length was 24 months. (Table 1.) The average length of the female anamnesis was 19, and male 27 months. Pain, as a reaction to pressure of osteochondroma onto the surrounding structures, appeared in 36 (97%) patients, while only one patient did not register the presence of a pain. The clinical record varied depending on the type of the bone with osteochondroma. All patients who had osteochondroma on long bones at the same time had pain, while pain appeared in 80% of patients who had osteochondroma on flat bones. Compression of soft

tissues was proved in 9 (24%) patients, out of which localization of osteochondroma was exclusively on long bones.

Table 1. Length of case history

Months	N	%
2	2	5.4
5	1	2.7
6	4	10.8
7	1	2.7
8	3	8.1
10	4	10.8
11	1	2.7
12	4	10.8
14	1	2.7
24	5	13.5
36	4	10.8
44	1	2.7
48	3	8.1
54	1	2.7
96	1	2.7
108	1	2.7
TOTAL	37	100.0

Out of 37 patients who were diagnosed with osteochondroma, 34 had benign lesion, and 3 of them had some signs of malignity. Out of 3 patients who were diagnosed with malign transformation, osteochondromatous secondary chondrosarcoma, there were 2 females and 1 male. In female case, a malign lesion was diagnosed on pubic bones (flat bones) in the middle of the fourth decade (35 years old), while in male case, tumor on metaphysis of tibia (long bone) was diagnosed somewhat earlier, at the end of second decade (20 years old). Concerning classification of skeleton bones, 2 malign lesions were on the flat bones, and one on the long bones. The length of anamnesis of patients with malign lesions was between 12-48 months. All the patients with malign change reported presence of pain, while compression was present only in the case of tibia lesion, whereas it is completely absent in the case of pelvic localization. The length of anamnesis in our case varied from 2 to 108 months (9 years). In case of both patients, lesion was localized on femur. In patients who had osteochondroma localized on tibia, the length of anamnesis was the shortest being 4 ± 2 months.

Taking into consideration thickness of the cartilage cap, patients were divided into three groups in intervals. Thickness of the cartilage cap of the patients with malign signs was over 68 mm, and all the three of them are in the last interval in the table showing thickness of the cartilage cap. (Table 2.)

Table 2. Thickness of a cartilage cap (mm)

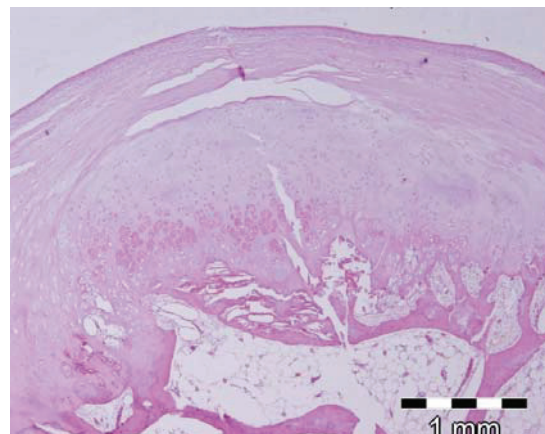
Thickness of the cap (mm)	N	%
0-3	17	45.9
3, 1-10	17	45.9
>10, 1	3	8.1
TOTAL	37	100.0

Morbus exostosis was proved in 6 (16%) patients, out of which compression was present in only one of them, and all six of them reported the presence of a pain. None of the patients with osteochondromatosis had signs of malign alteration. In 3 (8%) patients recidive was found. Common localization on metaphysis of long bones was characteristic for all the three patients. All the patients with recidive also reported the presence of pain, while neither of them had compression.

Thickness of the cartilage cap varied between 2,5-5,1 mm. None of the patients with recidive had malign alteration of osteochondroma, and Morbus exostosis was present in only one of them. All the patients diagnosed with secondary chondrosarcoma (2 males and 1 female) were adults, and the length of the anamnesis was over 24 months. In two patients, lesion was localized in axial skeleton (pubic bone) while in one patient, tumor was found on tibia.

Width of the cap in these tumors was from 68 mm to 120 mm, which statistically highly differ from the thickness of the caps in benign exostosis, ranging from 0,6mm to 7,8mm (Photo 1.). Statistic tests also determined the correlation of the cartilage cap width including sex, age and the length of anamnesis. The used tests did not show statistical significance between the mentioned parameters (Mann-Whitney U for sex: $U=103$ $p>0,05$, Spearman's coefficient for age $\rho=0,129$ $p>0,05$ and length of anamnesis: $\rho=0,215$ $p>0,05$).

Photo 1. Detail from previous macrophotography. Cartilage cap with micrometer morphometric scale (HE,100x)



Discussion

Osteochondroma is a benign tumor which, by the definition of World Health Organization (WHO), belongs to the benign tumors of the bones which create chondroid matrix.⁵ The largest influence of this lesion comes from the fact that it is the most common bone tumor. Its high incidence and possibility of malign transformation of the cartilage cap into the secondary chondrosarcoma make this tumor interesting for medical staff at the clinic and pathologists.⁶

Research showed that appearance of the tumor itself is the most common during the second life decade.²⁻⁶

Most of the authors emphasize that there is a double predilection of the male patients comparing to the female patients.^{1,2,4,7} Similar distribution between the sexes was found in our sample, with 13 samples being female and 24 being male.

Osteochondromas developed from the bones, which develop by endochondral ossification, and the biggest biological and metabolic changes happen in the knee region. The high incidence of tumors in the knee region is explained by frequent injuries of those regions of kids and adolescents while engaging in different activities.⁵ According to the research, the most common localization of osteochondromas distal femur,² while this research shows that, besides femur and tibia, localization of osteochondroma on scapula and pelvic bones is significantly common. Frequency of tumor appearance on long bones (95%), is explained by endochondral ossification.² This also explains a higher frequency of osteochondroma of the long bones in people whose epiphysis plates are still not closed comparing to the people with closed epiphysis plates.²⁻⁵

The shortest anamnesis in this series is 2 months and the longest 9 years. The shortest anamnesis, 4±2 months, was found in patients who had exostosis on metaphysis of proximal tibia. Tumor of these patients was joined by an intensive pain and accentuated compressive syndrome. Such clinical image and short evolution of tumor are consequence of the compression syndrome on nervus peroneus.⁸

Morphometric analysis showed that thickness of the cartilage cap significantly differs from lesion to lesion. Minimal thickness was only 0,6mm, at a 4-year-old patient, with localization on scapula and anamnesis of 3 years.

Majority of the authors considers that the thickness of the cartilage cap larger than 25 mm increases a chance of malign alteration of osteochondroma.¹⁻⁸ The results of our series fit into this research. De Andrea et al. note in their

research that the percentage of the malign alteration in patients with solitary osteochondroma was smaller than 1%,⁷ which is not in correlation with the results of this research, where out of 37 patients, even 3 of them (8%) had malign alteration.

Different authors report recidive of the tumor in 2-4 % patients,⁴⁻⁶ while according to the results of this research, the percentage of the recidive is somewhat larger and amounts to 8%. Almost four times higher frequency of recidive in this study can be explained by the fact that these are lesions which are not primarily surgically removed in the reference center for bone tumors, but in other institutions, and are subsequently sent to re-excision.

Conclusion

By morphometric determination of the width of the cartilage cap, it is possible to envisage biological behavior of exostosis. The width of a cartilage cap, in correlation with clinical and radiology parameters, is a significant predictive parameter of biological behavior of osteochondroma.

Localization of changes between the pelvic and supra-acetabular segment have higher incidence of malign alteration of exostosis.

Radiologic and pathohistologic indicators of malign transformation are increase of the height of the cartilage cap above 2.5 cm with characteristics change of chondral layer of neoplasm verified exclusively by MRI (magnetic resonance imaging).

References

1. Zhang F, Liang J, Guo X, Zhang Y, Wen Y, Li Q, Zhang Z, Ma W, Dai L, Liu X, Yang L, Wang J. (29 August 2013). "Exome sequencing and functional analysis identifies a novel mutation in EXT1 gene that causes multiple osteochondromas." *PLOS ONE* 8 (8). Retrieved 25 March 2014. <http://dx.doi.org/10.1371/journal.pone.0072316>
2. Fletcher DM, Unni KK, Martens F: WHO Classification of Tumours of Soft Tissue and Bone. Pathology & Genetics. IACP Press. 2013.
3. Wirganowicz P.Z. Watts Hg. Surgical risk for elective excision of benign exostoses *J Pediatr orthop.* 1997; 17(4):455-459. <http://dx.doi.org/10.1097/00004694-199707000-00008> <http://dx.doi.org/10.1097/01241398-199707000-00008> PMID:9364382
4. Nottrott M, Hards J, Gosheger G, Andreou D, Henrichs M, Streitbueger A. Benign cartilage tumors. What should I do with incidental findings? *Unfallchirurg.* 2014 Oct;117(10):905-14. <http://dx.doi.org/10.1007/s00113-014-2578-3> PMID:25274388

5. Mohindra M, Tiwari A, Gogna P, Thora A. Humeral diaphyseal osteochondroma causing median nerve injury. *J Coll Physicians Surg Pak*. 2014 Mar;24 Suppl 1:S43-5. PMID:24718003
6. Kwon OS, Kelly JL. Delayed presentation of osteochondroma on the ventral surface of the scapula. *Int J Shoulder Surg*. 2012 Apr;6(2):61-3.
<http://dx.doi.org/10.4103/0973-6042.96996>
PMid:22787335 PMCID:PMC3391786
7. De Andrea CE, Hogendoorn PC. Epiphyseal growth plate and secondary peripheral chondrosarcoma: the neighbours matter. *J Pathol*. 2012 Jan;226(2):219-28.
<http://dx.doi.org/10.1002/path.3003>
PMid:21956842
8. Bernard SA, Murphey MD, Flemming DJ, Kransdorf MJ. Improved differentiation of benign osteochondromas from secondary chondrosarcomas with standardized measurement of cartilage cap at CT and MR imaging. *Radiology*. 2010 Jun;255(3):857-65.
<http://dx.doi.org/10.1148/radiol.10082120>
PMid:20392983
<http://dx.doi.org/10.1148/radiol.10082120>
PMid:20392983

Korelacija topografske lokalizacije i kliničkih manifestacija u cilju indikacija za hirurško liječenje osteohondroma

SAŽETAK

Uvod. Osteohondrom je najčešći benigni tumor kosti koji se javlja u dva oblika, kao sesilni i kao pendularni. Čini do 50% svih benignih tumora koštanog tkiva, sa dvostrukom predilekcijom ka osobama muškog pola. Prekriven je hrskavičnom kapom različite debljine. Debljina hrskavične kape preko 30 mm može ukazivati na malignu transformaciju u sekundarni hondrosarkom.

Cilj rada. Utvrditi da li postoji korelacija između epidemioloških karakteristika pacijenata, patohistoloških karakteristika, debljine hrskavične kape i biološkog ponašanja tumora.

Ispitanici i metode. Studija presjeka obuhvatila je 37 ispitanika kojima je u periodu od 12 mjeseci, tokom 2014.godine, na Institutu za patologiju Medicinskog fakulteta u Beogradu dijagnostikovano osteohondrom. Pacijentima je deskriptivno analizirana starost, pol, lokalizacija, kliničke manifestacije i dužina trajanja anamneze. Morfometrijski je određivana debljina hrskavične kape na patohistološkim preparatima resekovanih tumora. Od 37 bolesnika kojima je dijagnostikovano osteohondrom, kod 3 (8%) je nastupila maligna alteracija hrskavične kape. Debljina hrskavične kape kod sva tri je bila preko 30 mm, a kretala se od 68-120 mm. Recidiv se javio kod 3 (8%) pacijenta.

Diskusija. Najveći značaj ove lezije proističe iz činjenice da je to najčešći koštani tumor, velike incidencije, i mogućnost maligne transformacije hrskavične kape u sekundarni hondrosarkom čine ovaj tumor interesantnim za kliničare i patologe.

Zaključak. Širina hrskavične kape u korelaciji sa kliničko-radiološkim parametrima je značajan prediktivni parametar biološkog ponašanja osteohondroma.

Ključne riječi: osteohondrom, debljina hrskavične kape, maligna alteracija.