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HISTORY AND PALAEOPATHOLOGY OF MALIGNANT TUMOURS

ABSTRACT: *Historical sources furnish valuable, but only indirect data on occurrence of past malignant tumours, sometimes also on their kinds or therapy, but not on their morphology and frequency. In distinction to it, palaeopathology, using examination of finds of cancers by gross morphology, standard radiography, computed tomography, as well as light microscopy, scanning or transmission electron microscopy and laser confocal microscopy can distinguish malignant tumours from the benign ones, and both kinds of tumours from other pathological conditions. Assembling results of our own investigation together with data on cases from the literature, we created a databasis of 183 skeletal finds from the Old World, divided into 5 diagnostic groups. Mean ages at death of the afflicted people for each group were determined. Their geographic distribution comprised 20 European, 4 Asian and 2 African countries with the highest representation of finds from Ancient Egypt with Nubia. The assembled series enabled a trial of their diachronic study. In Europe, they were only rarely found in prehistoric time before beginning of the Christian era, while in later periods they revealed an increase as expected. In Egypt with Nubia, on the contrary, they increased in a wavy manner with peaks in periods of cultural upheaval.*

KEY WORDS: *Skeletal cancer – Old World – diagnostic groups – mean age – geographic distribution – diachronic growth – Europe – Egypt with Nubia*

INTRODUCTION

Cancer, malignant neoplasia, one of the most treacherous diseases of mankind, attacks a steadily growing number of people. Its causes are not yet sufficiently known, and because of it, its prevention and therapy are not always successful. Unravelling them is one of the most pressing goal of modern medical research.

In connection with it also *history of medicine*, aided by *palaeopathology*, are focusing their interest towards study of the history of tumours of past people, especially the malignant ones.

Such research can hopefully contribute in efforts to suppress cancer.

Literature on this subject is very rich in both mentioned disciplines (Capasso 2005, Halperin 2004), to quote only the most prominent ones, for others we point out our recent monograph (Strouhal, Němečková 2008).

OUTLINE ON THE HISTORY

Written sources can offer informations about knowledge of tumours by healers and ancient physicians in various past periods starting with Ancient Egypt, whose medical papyri reveal beginnings of scientific medicine. Of the three kinds of protruding formations quoted in the Papyrus Ebers, the last one called *aet*, concerning soft tissue, when hard as a stone, had to be treated with a knife. In the same papyrus a recipe describes a suspect cancer of uterus, appearing also in the Kahun Papyrus. In the Papyrus Smith case 45 describes ball-like tumours on the chest whose character is questionable.

More scientific approach can be found in Corpus Hippocraticum with distinction of malignant tumours called karkinoma from the benign ones, or from other protruding formations. In the book „On women diseases“ cancers of nose, uterus, its cervix and breast are mentioned, the last one

with metastases (wrongly in the neck instead in the axillar lymphatic nodes). In the same book and in the book „On nature of woman“ also symptoms accompanying cancers of breasts and uterus are described. The author mentions also cancer of stomach and gut as well as of melanoma.

Also different authors of Ancient Rome knew well existence of cancer and organs in which it can be found. Not always they were able to distinguish them from other diseases leading to ulceration. They did not know the ways of their dissemination and the connexion of the metastases with the primary tumours. Therapy of the breast cancer was mostly surgical, in the other forms palliative. Often quotation of cancer suggest that it could be a common disease, but its incidence cannot be determined. Operation technics of breast cancer are well described by authors of the Byzantine Period and knowledge of cancer has been preserved also in several medical books written in Arabic during Early Medieval Period.

Medicine of the Middle Ages and Early modern period, repeating the classic conception of cancer as manifestation of excess of black bile, one of „the four body fluids“, added a great deal of knowledge about malignant tumours, while their therapy remained inefficient except for removal of the breast cancer, a horrible operation performed without narcosis and antiseptics and leading often to death. It was only 19th century with birth of modern medicine with narcosis and asepsis as well as radiology, when oncology started its tremendous success.

Review of written sources could furnish only indirect data on occurrence of past cancers.

We get informations about their kinds and used therapeutic means, but no on their morphology and frequency. To fill up these gaps, there exists now another efficient tool – palaeopathology – which reveals *primary sources* – finds of concrete cancers.

PALAEOPATHOLOGICAL APPROACH

The first direct find was made by a British physician in 1824 in a session revealing secrets of an ancient Egyptian mummy of a woman Irtysenu in London to his friends. Dissecting her body he found allegedly hydrops of the ovarium, which was later diagnosed as malignant cystadenoma. Results or its modern re-examination are not yet at hand (Harer, Taylor, quoted by Nunn 1996: 65, 81).

Since then finds of tumours, also malignant ones, multiplied. Some of the early diagnoses were, naturally, incorrect – either identifying cancer in changes produced by other diseases, or considering features of cancer as different disease. Later things changed, and we cannot agree with Micozzi (1991) that most diagnoses – except for the nasopharyngeal cancer – were not neoplastic.

The Czech project on history and palaeopathology of tumours by Strouhal, Němečková and Vyhnánek was started in 1992–1994 as a project of the Grant Agency of Czech Republic. It continued later in spite of the tragic death of one of our collaborators, the radiologist Luboš Vyhnánek, to

whose memory our recent monograph was dedicated (Strouhal, Němečková 2008). The project aimed at study of not only newly found tumours, but also at revision of not well documented or queer cases, complemented by screening of cases published in the available dispersed anthropological, archaeological and palaeopathological literature.

Use was made of finds of skeletons afflicted by tumours mainly from archaeological sites with sufficiently established dating, determination of sex and age at death, as well as a sound morphological determination and diagnosis.

MATERIAL AND METHODS

Besides several unusual benign tumours, data on about 250 finds of malignant ones were collected, of which 188 were well documented to be included in our study. Of them 40 were investigated by us. Our methods comprised external examination of gross morphology, standard radiography and computed tomography as well as various modern methods of histology as light microscopy, scanning electron microscopy, transmission electron microscopy and laser confocal scanning microscopy. We limited our study to countries of the Old World and concentrated only on tumours malignant clinically.

Several casuistics of newly detected or revised malignant or benign tumours were published by us and our collaborators in current anthropological, palaeopathological and medical journals (quoted in Strouhal, Němečková 2008).

FREQUENCY OF DIAGNOSTIC GROUPS

For elaboration of the collected data it proved advantageous to join diagnoses of the single cases into five larger diagnostic groups which could be easier analyzed.

The first group were malignant tumours originating in connective tissue, which are called together *sarcomas*. Under this heading cases diagnosed as plain osteosarcomas, parosteal or juxtacortical osteosarcomas, as well as a few chondrosarcomas were joint. Together 21 cases from the total of our 183 analyzed cases of malignant tumours were identified (11.5 %). As example we include one of them, a rare case of an osteosarcoma situated on the skull vault, identified by us in the excavated skeletal material from a 13th–17th cemetery at Kyjov, district Hodonín, Moravia, Czech Republic (Strouhal *et al.* 1997, *Figures 1–6*).

The second group is composed of *hemoblastoses* of myelogenic origin. Of these the most often occurring was myeloma multiplex or plasmacytoma, derived from plasmatic cells of bone marrow, with 24 cases. Two other cases comprised Ewing sarcoma, developing from the unripe reticulum of the bone marrow. Two remaining cases of sarcoma from reticular cells (reticulosarcoma) and of a non-Hodgkin lymphoma were added. The 28 cases comprised 15.3 % of our material.



FIGURE 1. Osteosarcoma on right parietal bone of a 15–25 year old male from Kyjov, Czech Republic, in lateral view. Originally it reached over to the now missing frontal scale.

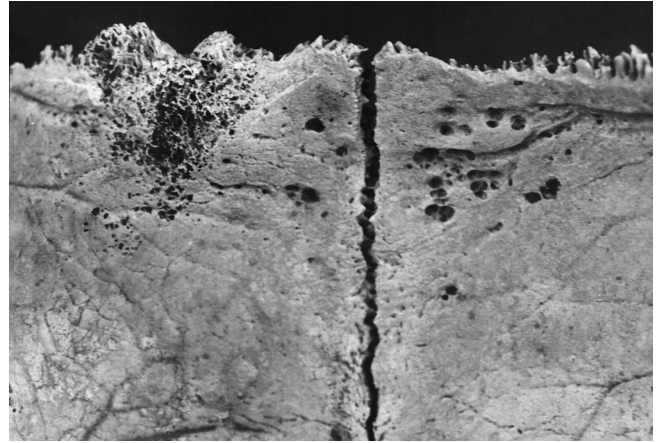


FIGURE 2. Less intensive growth of the same tumour on internal lamina of right parietale.



FIGURE 3. X-ray picture in rotated axial projection shows inhomogenous structure of the tumour with spots of lucidity. A sharply delimited lytic metastasis posterior to it did not perforate the laminae. Pacchioni granulations cause a merging polycyclic lucidity in left parietale.

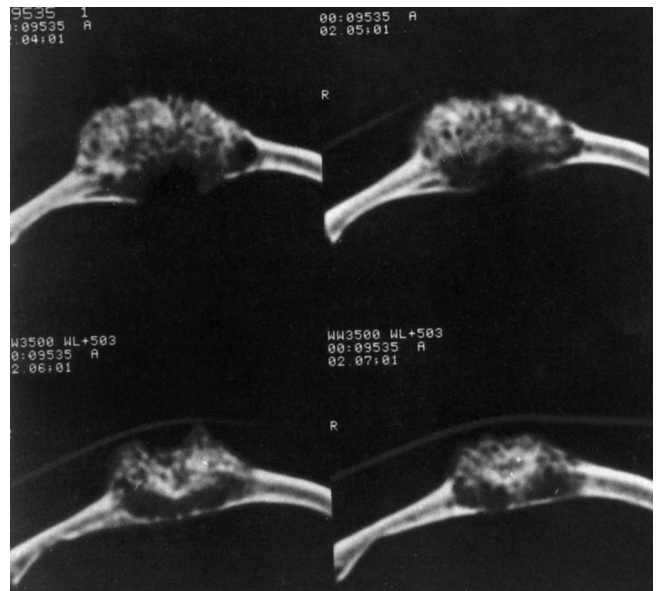


FIGURE 4. Four CT sections reveal lifting and interruption of the external lamina on edge of the tumour and slight bulge and partial interruption of the internal lamina. Structure of the tumour is inhomogenous with spiculae on the surface and areas of lucidity on its base.

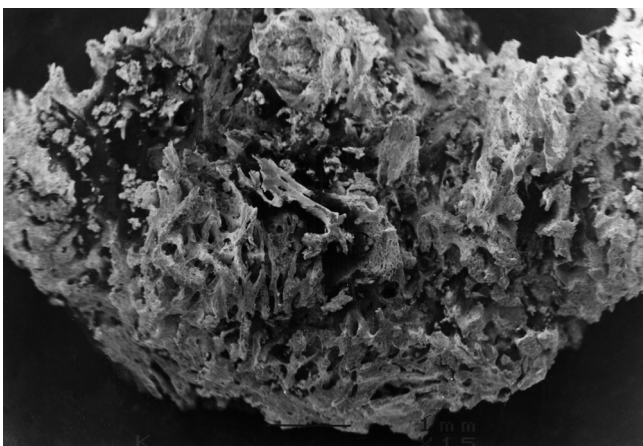


FIGURE 5. SEM (Scanning Elektron Microscopy) of the specimen for histological examination displays chaotic arrangement of bone trabeculae ($\times 15$).

FIGURE 6. A semithick histological section discerns intensively dyed calcified and light uncalcified areas of the growing tumour. There are several Howship lacunae after osteoclasts ($\times 150$). →



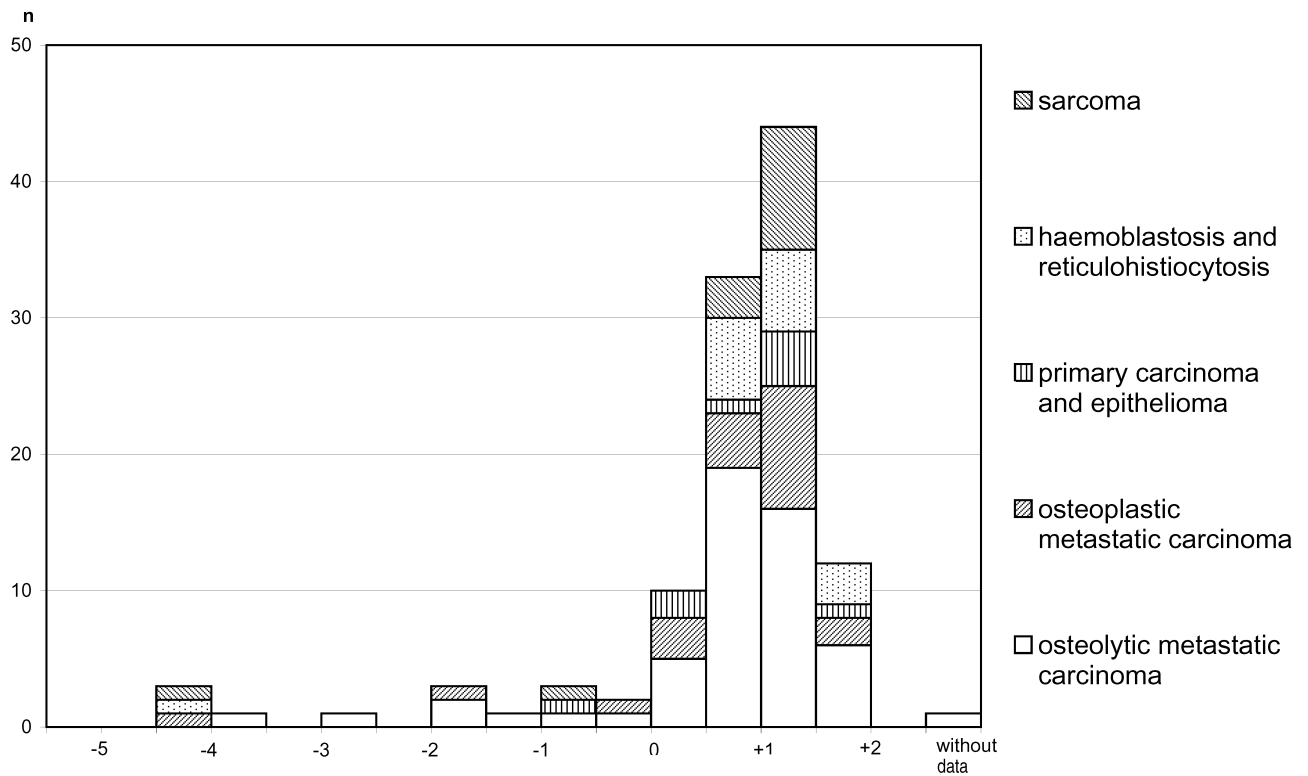


FIGURE 7. Diachronic increase of number of malignant tumours can be observed after beginning of Christian era in Europe (n = 113). Column of the last 500 years is anomalously low due to restricted number of investigated cemeteries. On vertical axis number of cases, on horizontal axis thousands of years (mark minus = BC., mark plus = AD.)

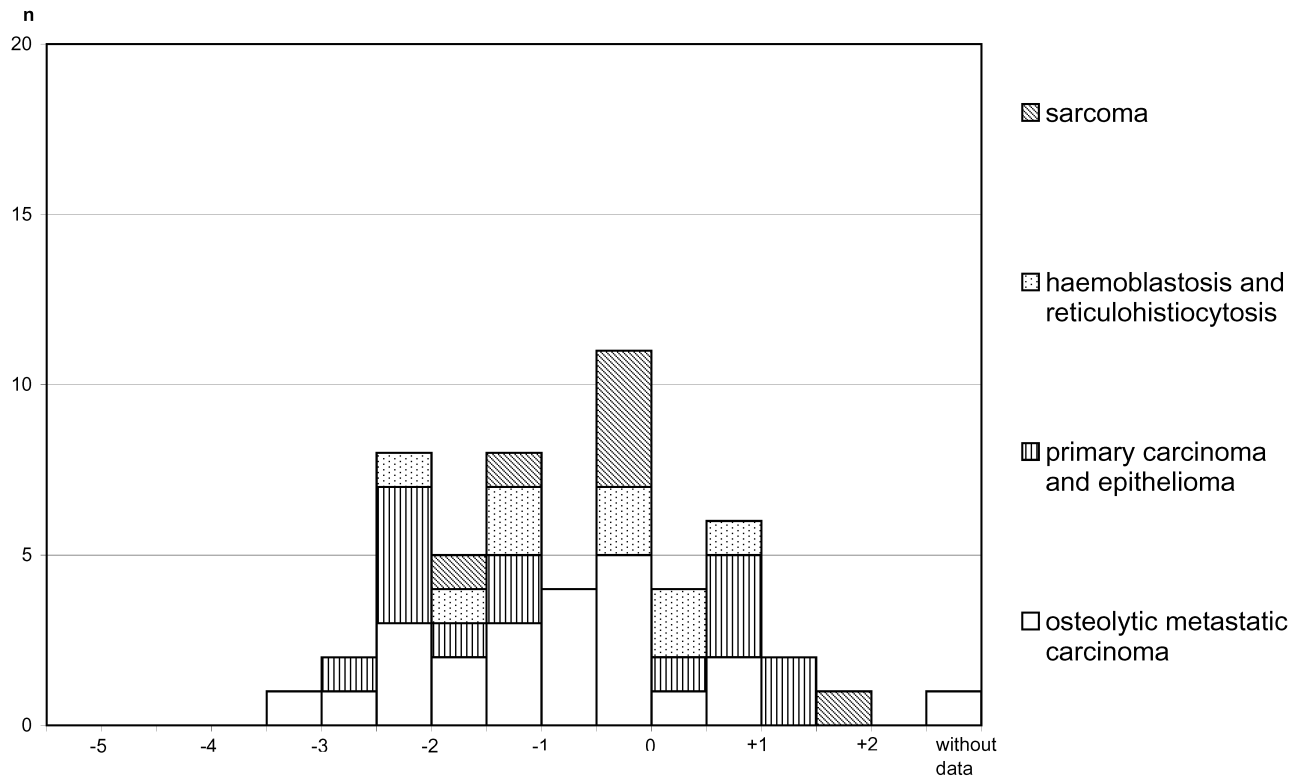


FIGURE 8. Diachronic increase of number of malignant tumours in Egypt and Nubia (n = 53). Depression in centuries AD was caused by decreasing number of investigated Christian cemeteries and ban on excavation of Muslim tombs.

The third group of *primary carcinoma and malignant epithelioma* joins 14 cases mostly of nasopharyngeal carcinoma, 2 cases of basocellular epithelioma, 2 cases of multifocal basocellular skin carcinoma, 4 cases of either epithelioma or skin or gingival carcinoma and 2 possible cases of colorectal carcinoma or chordoma. Together there are 26 cases (14.2%).

The fourth group of *osteoblastic and mixed metastatic carcinomas* is represented by 25 cases (13.7 %), among which dominate males (18 cases, 72 %) over females (5 cases, 20 %) and not sexed adults (2 cases, 8 %). This reflects that this kind of cancer attacks mostly over 50 years old males as the result of untreated or badly treated prostatic cancer. The smaller fraction in women derives probably from some progressed cases of carcinoma of the breast with accentuated osteoplasia.

The fifth and absolutely prevailing group of *osteolytic metastatic carcinomas* covers 83 cases (45.4 %) of our malignant neoplastic series. Primary cancers of various internal organs which metastaze into bone and create lytic metastases can be enumerated, as cancers of breast, thyroid, kidney, lung, urinary bladder, less often colon and rectum, mouth, stomach, uterus and ovarium. The origin of any of the single cases cannot be traced, however, in the single cases of metastases. The highest share of this group compared with the previous ones seems to be the result of high resistance of past people living longer with primary tumours until they – uncured – started to produce osteolytic metastases. This is contrary to the case of modern patients in developed countries, whose primary tumour can be either cured by efficient treatment, or in adverse case, can kill them prior to reach the metastatic stage.

DEMOGRAPHIC DATA

Our collected material of malignant tumours consists of 183 skeletal cases and 5 ones found in mummies, which in this report are left apart. Concerning its demographic composition, adults of known sex were afflicted with malignancies in 88.5 % (n = 162), while children and adults of undetermined sex in 11.5 % (n = 21). Of the sexually determined adults a great majority – 65.4 % (n=106) were males, while only 34.6 % (n=56) females. This may reflect greater exposure of males to carcinogenes, but could also be a result of greater resistance of male bones to destroying influence of the ground.

Concerning mean age at death, it was not always indicated precisely by different authors of the used literature, sometimes only as „youngish, adult, mature, senile or oldish“. For our statistics, only ascertained numerical data could be, therefore used, as follows.

Mean age was found different in the five diagnostic groups, into which our material have been divided.

The lowest mean age at death 16.1 years was established in children and young adults (n = 15) afflicted by *sarcomas*. Their range reached from 4 to 40 years.

With *hemoblastoses* (mainly multiple myelomas) males (n = 12) died in average as 42.4 years old, females (n = 5)

as 51 years old and unsexed individuals (n = 2) as 20 years old, all together in 42.4 years (range 16–56 years).

Osteolytic metastatic carcinoma ended with death in males (n = 39) in 42.9 years, in females (n = 24) in 44.9 years, both sexes together in 43.5 years (range 25–70 years).

In *primary carcinomas* and *epitheliomas*, age at death was found in males (n = 14) 46 years years), in females (n = 4) 43.8 years, both sexes together 45.5 years (range 32.5–75 years).

The highest mean age at death was established in osteoblastic and mixed carcinoma – in males (n = 16) 51.5 years, in females (n = 4) 47.5 years, in both sexes together in 50.7 years.

If sexed individuals with tumours are taken together, females (n = 41) showed only slightly greater mean age at death (44.6 years) than males (43.7 years).

GEOGRAPHIC DISTRIBUTION

The collected cases originate in 26 countries of the Old World, 20 European, 4 Asian and 2 African ones.

The biggest number of their finds comes from cemeteries of Ancient Egypt (41) and Nubia (stretching from to-day Egypt to Sudan, 12), yielding together 53 finds (29 % from the total of 183). In big distance Great Britain (20, 10.9 %), Germany (19, 10.4 %), Hungary (13, 7.1 %), Czech Republic (10, 5.5 %) follow. Between 4.9–2.1% cases originated in Spain, Asian part of Russia, Japan, Switzerland, France, Belgium, Netherlands, and Italy. Remaining 12 countries attained only 3–1 (1.6 – 0.5 %) cases.

This geographical distribution is not a result of the real frequency of tumours in these various countries or number of their populations. They reflect the intensity of archaeological examination of cemeteries in single countries, the amount of uncovered and stored human remains, submitted to examination, and activity of the anthropologists, possessing knowledge how to identify tumours and study them, or hand them to palaeopathologists. These conditions have been best fulfilled in Egypt and Nubia.

COMPARISON OF DIACHRONIC INCREASE

The collected identified series was used for construction of diagrams, which visualize the diachronic increase of finds of malignant tumours by comparing their number in periods of 500 years. Data for Europe show a regularly speeding up growth starting at the beginning of the Christian era. Before it, in prehistoric times from the Neolithic to year 0, the frequency of finds was minimum, with 1.5 for a period of 500 years (*Figure 7*). Data for Ancient Egypt together with Nubia present, in the contrary, already in the same time a slow increase in wavy manner, with peaks in periods of flourishing culture (*Figure 8*).

CONCLUSION

Our results reflect the situation at the end of 2007. Since then, published finds of malignant tumours are increasing in an assessed number of 5 to 10 per year, unfortunately being published in journals of different disciplines, sometimes not easily accessible. Moreover, there exist still old, not accurately reported finds, which in their collections could not been identified to be reexamined. By adding them, our results are open to be complemented or changed in future.

Our aim was directed to evoke interest of archaeologists, anthropologists, palaeopathologists and various medical specialists towards the longly neglected field of palaeoncology, which can bring further information to past history of malignant tumours. Its knowledge can contribute to better understanding of its contemporary character.

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