Fistulography: a new method in palaeopathological examinations

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Abstract – The authors applied a new method in palaeopathological examinations. They analysed a fractured sporadic male tibia from the 11—12th century cemetery at Szentkirály. Fistulography affords new possibilities in the diagnosis and research of diseases on fossil bones. With 2 photoplates.

INTRODUCTION

The very first paper on palaeopathology was published just three years after the discovery of X-ray. It gave an account of the utilization of X-ray in the analysis of an Egyptian mummy (Petrie 1989 in Braunstein et al. 1988). Pailes (1930) already considered X-ray examinations indispensable in palaeopathology. Since then radiology has taken up its position in the analysis and diagnostics of fossil skeletal material, of skull traumae, of trepanations (Regoly-Merei 1962), of osteomae and of tuberculated bone metastasis (Strouhal & Vyhnanek 1982), of degenerative spine alterations (Kramar 1982), of syphilis (Williams 1932), of osteomyelitis (Lax et al. 1982) and of a large number of other clinical pictures and conditions.

X-ray analysis has an especially significant role to play when determining the sex and diseases or even the very breed of the wrapped up mummies (Gray 1967). The pathologic observation of mummies and bog corpses was made much simpler and easier by radiology because it has no destructive effects and the wrapping can be left intact (Braunstein et al. 1988). More recently the modern image producing systems, computer tomography, magnetic core resonance, etc. also became established elements of palaeopathological diagnostic (Marx & D'Arria 1988). These most up-to-date methods and equipment are available only in a small number of institutions. Therefore we deemed it necessary to utilize the special technical possibilities of traditional radiology (contrast material examinations, magnified pictures tomography, X-ray film densiometry, etc.), too (Pap & Józsa 1988).

FISTULOGRAPHY

Compounds having different radiation absorbability to that of the body are called contrast materials. Those with greater absorbability are positive contrast materials while those with lesser absorbability are negative ones. In every day radiological practice organic iodine combinations in water or oil solution or the water suspension of barium sulphate serve as positive contrast materials. The former ones are utilized in the examination of urinary system, of biliary canals, of blood-vessels, of brain and myelon, of the skull and of the spinal canal. Barium sulphate is used in the X-ray diagnostics of the stomach-enteron system. Contrast materials are relatively seldom applied in bone X-ray examinations.

Fistulography, the filling up of the fistula is carried out to determine bone fistula and the location and spread of the bone lesion keeping up the fistula. In this process
contrast material is injected into the fistular duct opening to the surface before the X-ray examination.

Fistulographic techniques applied in living individuals are not suitable for fossil bones. While abnormal ducts and cavities of the living have osseous-interstitial tissue walls, the viscera of bones found in graves perished long ago. The cavity of the previously closed ossifluent abscess has free access to the medullary canal. For this reason the watery and oily contrast materials used for living patients proved to be unsuitable for palaeoradiological purposes because of their low viscosity.

As a first step of our examination we had to compound a contrast material that would not „leak out” from the ossifluent abscess cavity. We made up an oily contrast material containing MicropaqueR iodine with Suspensio zinci oleosa (Formula Normalis, Pharmacopoea Hungarica VI.) preparation. The zinc contents of this suspension improved the radiation absorbability of the contrast material. The contrast material we produced was a white oily mass with the consistency of honey. Microscopic control found the size of particles being under 20 μm.

**ANALYTICAL TECHNIQUES**

The surface of the bones to be examined was washed and dried then the remaining sand was removed by air-flow. The still remaining soil particles were washed out by 150 Hgmm pressure water-jet through the foramen nutritium from the medullary cavity. After this the bones were X-ray illuminated by a Medicor GT-2 type X-ray machine. This way we could separate intraosseal alterations. Then double-direction X-ray pictures were taken of the bones. The fistulae of the bone surfaces were observed with 6–100 x magnification by a Zeiss „Bioplast” stereomicroscope. A thick hypodermic needle was intubated into the fistular duct selected by microscopy – provided it was spacious enough. When a fistular duct proved to be too narrow we drove in a trocar (with 2 mm outside diameter) of the type used in the phlebography of the caput femuri through the fistula. Than we injected contrast material from a plastic syringe under approximately 100 Hgmm pressure until meeting resistance. The X-ray pictures of the bones were taken after removing the syringe but with the needle remaining in place.

**FISTULOGRAPHY IN PALAEOPATHOLOGY**

Our material came to light from the excavation of the late medieval (11th-17th c.) cemetery of Szentkirály directed by A. PÁLÓCZI HORVÁTH. A stray tibia was found in the back-filled soil in 15th-16th c. graves were excavated. This tibia probably originated from an earlier grave. The adult male (11th-12th c.) had a well-preserved 35.8 cm long tibia. A robust rough ossified callus can be seen on the border of the middle and the lower thirds of this bone. Several minor fistular ducts can be observed on the medial side of the callus and a 2 mm diameter duct’s opening can be seen at about 3 cm from the edge of the callus on the rear surface (Plate I:A). The fracture healed with 15° deviation from the longitudinal axis and 8° deviation from the sagittal axis.

The X-ray picture showed no sign of the original fracture. The ossal cortex became thick and the medullary canal tapered. An irregularly shaped approximately 1 cm diameter sequester can be suspected within the callus area in the lateral picture.

Fistulography was executed with 5 ml of contrast material via the wider fistular hole on the rear surface. The contrast material filled up an irregular abscess system in the medullar cavity of the tibia (Plate I:B). In the area of the callus the thickened cortex tapered down the intraosseal abscess and gave it an hour-glass shape (Plate I:C).
A sequester of irregular form took shape within the abscess (Plate II). The macroscopic and the radiological analysis indicated that the young man of medium stature must have suffered this transverse fracture of his tibia at least 1-2 years before his death. Presumably the fracture was a trauma of first degree openness (not more than 1 cm² skin injury caused by the sliding of the fractured end). The fractured limb was secured as necessary and the injured man could ease it of burden for the time required. The open wound led to infection resulting in the bone's purulent inflammation and necrosis, in the forming of a sequester and in fistular osteomyelitis. In spite of the septic complication the fracture was healing with proper stability in a satisfactory position but the infectious process did not terminate and the injured man had an active fistula to the end of his life. Though the fracture was healing no restitua ad integrum took place. There was no abnormality indicating nutritional troubles (rachitis, scorbute, Harris-line) on the bone. Arthrosis did not develop yet as it could also be determined from the articular endings. This fact also made it probable that the injured man died within 1-3 years after the fracture and so there was not enough time for arthrosis to develop as a result of abnormal biomechanics brought about by axial deviances. As a more far ranging conclusion we may state that the people of the given period (11th-12th c.) possessed the knowledge of securing fractures and perhaps of follow up treatment too. This way fractures could be healed and the injured person could take full use of their limbs until the end of their lives. However, contemporary medicine was helpless when faced with septic complications.

CONCLUSIONS

The examination methods of macroscopic palaeopathology cannot be sufficient for the scientific recognition of the diseases of historical times and for the determination of their relative frequencies. The X-ray analysis of bone material tripled the number of clinical patterns and conditions that can be recognized (PAP & JÓZSA 1988). Therefore we consider it necessary to carry out X-ray examination of all bones suitably preserved. Skeletal abnormalities with no marked macroscopic characteristics mostly found detailed and correct diagnosis in X-ray analysis (LAX et al. 1982). This way new data can be obtained in cases where even the image of the sawn-up bone supplied no information (REGÖLY-MÉREI 1962).

Our experience led us to the conclusion that traditional X-ray illumination or photography is far from being satisfactory in a good number of cases. Therefore we tried to apply some X-ray techniques – previously used only for living subjects – for palaeopathologic material as well. (We adapted these procedures for the object's special demands.)

As far as we know, fistulography was not yet applied in palaeopathology. We managed to adapt this decades-old examination method of living bodies for the special needs of palaeopathology and this way we found a method to establish accurate diagnosis without ruining the findings. We hope that this present briefly introduced case demonstrated the place and the possibilities of fistulography in palaeopathology.

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References

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A = The fistular duct opening on the front surface is marked by the arrow. — B = The abscess in the medullary cavity was located on the two sides of the fracture and of the callus. The arrows point to the limits of the abscess filled up with contrast material. — C = The callus section (arrow) tapering the abscess cavity for hourglass shape.
A = A fracture healed with massive callus on the tibia (lateral view). — B = A sequester and an abscess cavity can be suspected in this image. — C = The abscess cavity system is clearly outlined by fistulography (lateral view)

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