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La corrispondenza va inviata a V. Gazzaniga/E. De Angelis, Dipartimento di Medicina Sperimentale, Sezione di Storia della Medicina, Policlinico Umberto I, Viale Regina Elena 324- 00161 Roma.

MALIGNANT TUMOR IN THE MUMMY OF FERRANTE Ist OF ARAGON, KING OF NAPLES (1431-1494)

GINO FORNACIARI

Istituto di Anatomia e Istologia Patologica
Laboratorio di Paleopatologia
Università degli Studi di Pisa, I.

SUMMARY

Ferdinand Ist of Aragon was king of Naples and an important figure in the Italian Renaissance. He died in 1494 at the age of 63 and his preserved mummy was recently exhumed in the Basilica of S. Domenico Maggiore in Naples.

*During the autopsy part of a hollow organ came to light which was labelled probable rectum. After re-hydration and cutting the specimen appeared a dark brown colour with numerous whitish areas of varying diameter (0.5 - 3 mm)
Immuno histological studies together with electron microscope analysis clearly demonstrate that.*

Ferrante Ist of Aragon, King of Naples and leading figure of the Italian Renaissance, died in 1494 at the age of 63; his mummy has lately been exhumed in the Neapolitan Abbey of S. Domenico Maggiore¹.

The autopsy of the artificial mummy of this obese individual (Fig. 1, A) evidenced in the small pelvis a fragment of hollow

Parole chiave/key words: Paleopathology - mummies - Renaissance

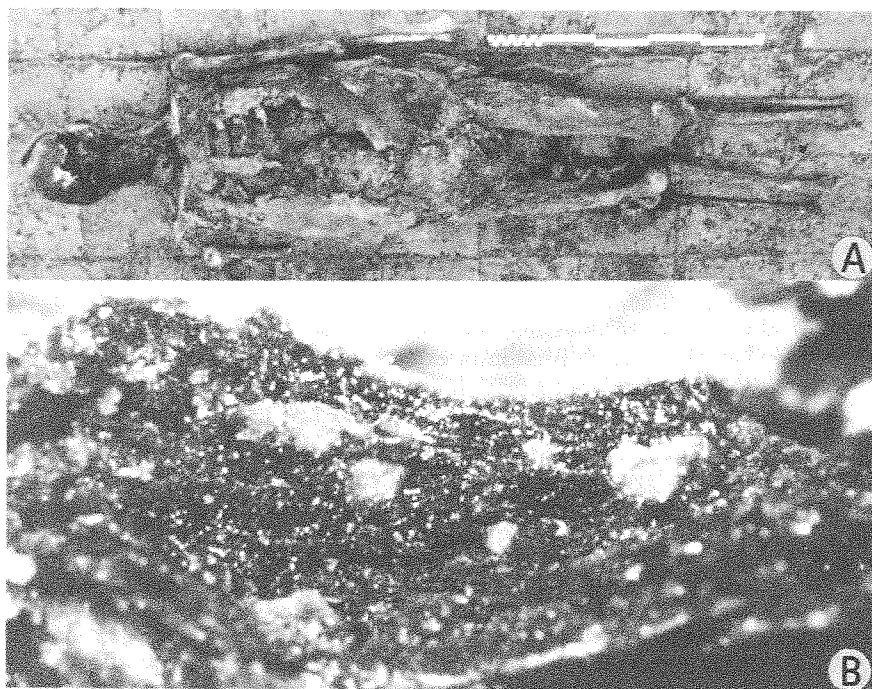


Fig. 1 - Mummy of Ferrante Ist d'Aragona (1494).
 (A) full mummy showing abdominal obesity (rule=50 cm).
 (B) cross section of tumour (x5).

fibrous tissue which reached the dimensions of 6x4x1 cm. after rehydration². The specimen was identified as probable *rectum*. On cross section it appeared dark-brown, with a lot of small roundish grey-white areas 0.5 to 3.00 mm in diameter (Fig. 1, B).

Histologically (Hematoxylin eosin, van Gieson) neoplastic epithelial cells disposed in cords, solid nests and glands (Fig. 2, A) were disseminated in a fibrous stroma containing scattered striated muscular fibers (Fig. 2, C). The cells were tall, crowded with abundant cytoplasm and pseudo-stratified pleomorphic hyperchromatic nuclei (Fig. 2, B). The mucus was scarce and

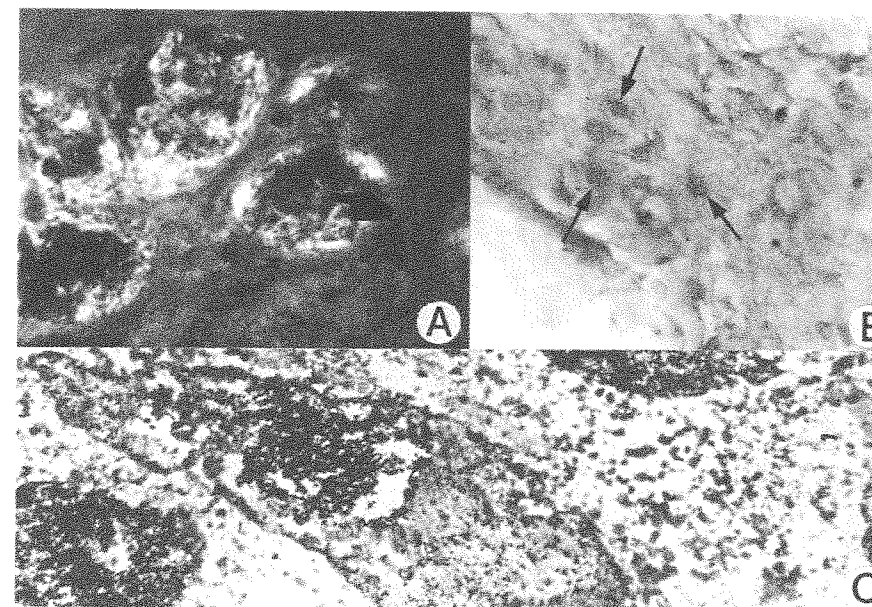


Fig. 2 - Histology of tumour.
 (A) pseudo-glandular lumina in fibrous stroma (EE X200).
 (B) glandular lumen with pseudo-stratified nuclei (EE X800).
 (C) malignant cells infiltrating muscular fibers (VG X1000).

limited to pseudo-glandular formations, as shown by the specific staining (Alcian-blue, PAS).

The application of a monoclonal antibody versus pan-cytokeratin KL1 (Sorin), an epithelial marker, showed strong intracytoplasmic immunoreactivity of the tumoral cells (Fig. 3, A), while the research of PSA (Prostate-specific Antigen, Dako) and CEA (Carcinoembryonic Antigen, Dako) resulted negative³. PCNA (Proliferation Cell Nuclear Antigen, Dako)⁴ was positive (Fig. 3, B), showing actively proliferating cells. The ultrastructural study⁵ evidenced well preserved pleomorphic nuclei with indented membranes (Fig. 3, C).

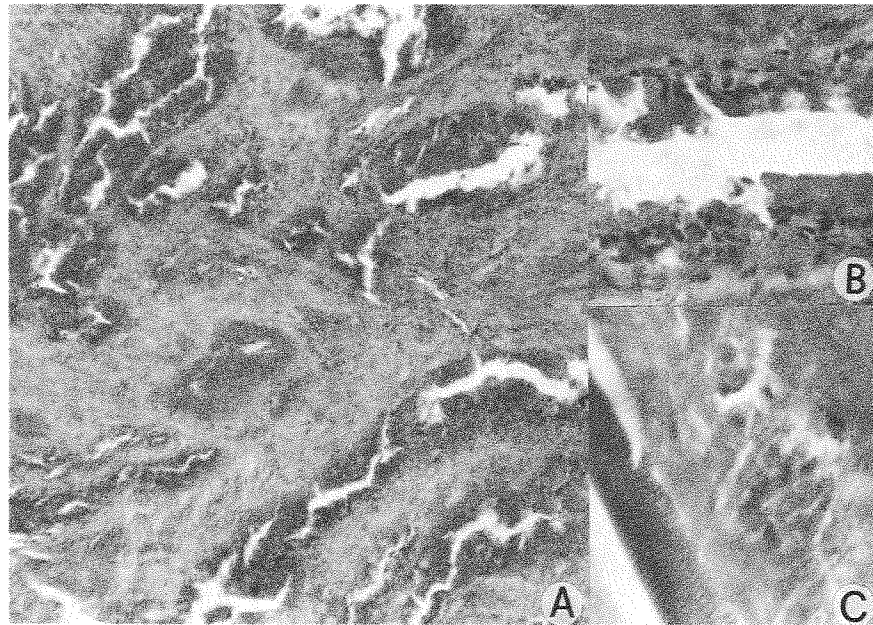


Fig. 3 - Immunohistochemistry and EM of tumour.
 (A) intense positive immunofluorescence with anti-pancytokeratin (X300).
 (B) nuclear PCNA positivity (arrows) (X600).
 (C) irregular neoplastic nucleus with indentations (X6000).

These results clearly point out a mucinous adenocarcinoma infiltrating the muscular-fibrous layers of the small pelvis. It is impossible to establish, with the available data, the site of the primary neoplasm: the histological appearance suggests prostatic adenocarcinoma or an adenocarcinoma of the digestive tract⁶.

The excellent, almost exceptional preservation of the histological structure is probably due to the very dry microclimatic conditions of the church, and partly to the substance used in embalming. As described in an ancient embalming handbook⁷, in Naples the bodies were washed with large quantities of *aqua vitae* and lye after being eviscerated; this treat-

ment is likely to have *fixed* the tissues, thus protecting their histological integrity. The specimen was later embedded in abundant vegetable resins flowing into the abdominal cavity.

The total number of well-documented soft tissue tumors in ancient civilizations is very poor, if compared to the thousands of complete autopsies carried out mummies. The following table is arranged according to different geographical areas and reports the complete list of literature references to primary soft tissue tumours from antiquity⁸:

Geographical area	Tumour	Reference
Egypt	Histiocytoma	Zimmerman 1981
	Leiomyoma	Strouhal 1976
	Cystadenoma	Rowling 1961
	Basal cell nevus syndrome	Satinoff and Wells 1969
	Squamous papilloma	Sandison 1967
Europe	Leiomyoma	Kramar et al. 1983
	Epithelioma	Fornaciari et al. 1989
	Adenocarcinoma	Fornaciari 1993
South America	Lipoma	Gerszten and Allison 1991
	Rhabdomyosarcoma	Gerszten and Allison 1991

The possibility of missing tumours during palaeopathological studies has been suggested: however, experimental studies showed that modern tumors mummified and rehydrated are easy to interpret⁹. This evidence suggests that tumours do not escape observation, but that they were actually less frequent in ancient times. It has been also suggested that in antiquity people did

not live long enough to develop tumours; furthermore, most of the carcinogenic substances developed after the Industrial Revolution. Finally, the genetic structure of the individual has probably played an important role in the incidence of cancer⁸.

The paleopathological study of the mummies of 11 adult individuals from the Abbey of S. Domenico Maggiore in Naples, dated back to XV-XVI century, with good or excellent preservation made possible the diagnosis of two cases of cancer. Alongside the present case, a malignant epithelial neoplasia was diagnosed in the mummy of Ferdinando Orsini, duke of Gravina in Apulia (Southern Italy), who died in 1549 for a tumour of the right naso-orbital region, most probably a widely destroying skin epithelioma¹⁰. Despite the very limited number of available specimens, we are in presence of an incidence of neoplastic pathology (18.8%) similar to nowadays. However, with regard to King Ferrante, some *environmental* factors were certainly present, such as an alimentation very rich in sugars, in fats and in foods of animal origin, peculiar to this wealthy class¹¹.

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Correspondence should be addressed to: G. Fornaciari, Istituto di Anatomia ed Istologia patologica, Università di Pisa, Scuola Medica, Via Roma n. 57 - 56126 Pisa (Italy).