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Radiological evaluation of the evisceration tradition in ancient Egyptian mummies

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ABSTRACT

Descriptions of the preparation of ancient Egyptian mummies that appear in both scientific and popular literature are derived largely from accounts by the Greek historians Herodotus and Diodorus Siculus. Our reliance on these normative descriptions obscures the wide range of techniques practised, and so stifles the study of geographic, chronological, and social variations in the practice. Using published descriptions in the literature for 150 mummies and 3D reconstructions from computed tomography data for 7 mummies, this study compares empirical data with classical descriptions of evisceration, organ treatment, and body cavity treatment. Techniques for accessing the body cavity, removal and treatment of the organs, and treatment of the eviscerated body cavity vary with time period, sex, and status, and are discussed in relation to their treatment in the literature and their radiological appearance. The Herodotean and Diodorean stereotypes, including the restriction of transabdominal evisceration to the elite and cedar oil enema evisceration to commoners, are falsified by the data. The transperineal forms are present only in elites, and chemical evisceration is not apparent at all. Additionally, the dogmatic contention that the heart was universally retained in situ, or replaced if accidentally removed, is also greatly exaggerated.

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Introduction

Evisceration, whether by transabdominal incision, transperineal incision, or anal cedar oil injection, is a well-recognised component of the Egyptian mummification tradition beginning in the Old

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Kingdom. Descriptions of Egyptian mummification, common to popular and academic literature, are derived largely from accounts by the classical authors Herodotus and Diodorus Siculus, particularly as they address the universal retention of the heart and the elite nature of excerebration and abdominal evisceration. Normative descriptions, based on the accounts of these and other late authors, impede the investigation of a wide range of variation in Egyptian mummification techniques.

The goals of this study are (1) to use the classical descriptions as hypotheses for empirical testing, using published descriptions and primary computed tomography (CT) data and (2) to examine temporal, spatial, and social variability in the evisceration tradition.

Variability within and between Egyptian mummification techniques is poorly appreciated in the literature (Nelson et al., 2007; Wade et al., 2011), in spite of some pioneering work done by Strouhal (e.g. 1995), the large-scale radiological survey of UK mummy collections conducted by Gray (1972), and the bioarchaeological survey of Nubia conducted by Smith and Wood-Jones (1910). Despite the high degree of variability apparent in the literature as an aggregate, researchers continue to focus on modern and classical stereotypes rather than on the rich temporal, spatial, and social variability in Egyptian mummification as it evolved across Egypt over the course of more than three millennia.

These stereotypes, however, can be used to formulate a hypothesis that can be empirically tested. If the classical accounts by Herodotus and Diodorus Siculus are correct, then evisceration via abdominal incision should be restricted to the elite, chemical evisceration per anum should be well-represented and be present primarily in commoners' remains, and the heart should be present in the overwhelming majority of eviscerated mummies, at least in the Late and Ptolemaic Periods within which these authors wrote.

This study focuses on CT as the best practice for non-destructive examinations of Egyptian mummies (O'Brien et al., 2009), particularly for the examination of evisceration, owing to its volumetric data and superior contrast resolution. The three-dimensional relationships between anatomical structures and the contiguity (or lack thereof) of tissues are extremely important factors in identifying highly desiccated structures. Likewise, subtle radiodensity differences may provide important information for differentiating among the tissues and materials involved in mummification.

Classical descriptions

Ancient descriptions of the Egyptian mummification process are extremely rare, and are currently limited to two Greco-Roman papyri describing ritual elements that accompany embalming (Goyon, 1972; Sauneron, 1952) and to scenes from the Late Period coffin of Djedbastiufankh (Colombini et al., 2000). Brier and Wade (2001) suggest that the details of the mummification process were seldom recorded due to the hereditary and territorial nature of the embalmer's trade (trade secrets), indicated in the Hawara Embalmer's Archive Papyri (Reymond, 1973). Ancient Egyptian literature does, however, provide the intent of the deceased's time in the *w'bt nt wty* ("workshop... of the embalmer priest") and *pr-nfr* ("the place of making perfect") (Shore, 1992, p. 232); to ensure the persistence of "the *sah*, the mummified corpse; *shuwt*, the shadow; *yib*, the heart; and most importantly, the *akh*, the *ka*, [and] the *ba* together with the *ren*, the individual's name." (Fleming et al., 1980, p. 2).

Classical descriptions are more explicit of the process, but are several millennia removed from the origins of Egyptian mummification. Herodotus' (2009, Bk II, pp. 86–90) Late Period description of Egypt and mummification is the description with which Egyptian mummy researchers are most familiar, including the deluxe treatment with transnasal excerebration and transabdominal evisceration and the lower cost cedar oil and water enema options. The Greek historian, Diodorus Siculus (1933, Bk 1, p. 91), wrote from the Ptolemaic period of three price points similar to those in Herodotus' account, and he provides further detail about the evisceration ritual and process, particularly the universal retention of the heart.

The fate of the viscera is discussed also in the Roman Period descriptions from Plutarch and Porphyry. In two places, Plutarch mentions that viscera were removed from the body and discarded; "the Egyptians, who cut open the dead body and expose it to the sun, and then cast certain parts of it into the river, and perform their offices on the rest of the body, feeling that this part has now at last been made clean" (Plutarch, 1928, p. XVI); and "the Egyptians who extract the viscera of the dead and cut them open in view of the sun, then throw them away as being the cause of every single sin that

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