Umbilical Concretion

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ABSTRACT

Umbilical concretion is a rarely encountered benign entity. Concretions typically form within an umbilical cleft which is unusually deep and consist of keratinaceous and sebaceous material. Lack of attention to umbilical hygiene usually plays a role in their formation. Concretions are generally asymptomatic and may only present clinically when complicated by inflammation or infection. Their appearance on imaging studies may be problematic for the radiologist given their rarity, particularly in the setting of a known or suspected intra-abdominal malignancy.

CASE REPORT

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An 85-year-old Greek woman with a history of Alzheimer's disease had recently moved to the United States from Italy. She presented to a breast surgeon with a fungating right breast mass after family members noted blood stains on her clothing. Breast biopsy confirmed invasive ductal carcinoma. The patient had staging computed tomography (CT) examinations of the chest, abdomen, and pelvis as well as a whole-body bone scan.

CT examination of the abdomen and pelvis showed a 1.4 x 1.6 centimeter soft tissue "mass" in the abdominal wall near the umbilicus (Figures 1a-1e). The radiology report described an indeterminate mass amenable to percutaneous biopsy. There were no other findings suspicious for metastatic disease.

Upon a follow up visit, her oncologist palpated a nodule beneath the umbilicus and noted some debris in the umbilicus. The patient next underwent an ultrasound examination using a linear high frequency probe. The ultrasound showed a heterogeneous, predominantly hypoechoic mass lesion "underneath the umbilicus" which showed no vascular flow on color Doppler imaging (Figures 2a and 2b). The etiology was again considered indeterminate.

Given her locally advanced breast cancer, the decision was made to obtain tissue biopsy from the umbilical nodule. During preparation for the biopsy procedure, it was noted that the patient's umbilicus was filled with firm, dark brown material. Biopsy approach planning sonography showed no change of the hypoechoic solid mass lesion in the subcutaneous soft tissues just superior to the umbilicus (Figures 2c and 2d). However, at real-time examination the nodular structure was clearly contiguous with the debris which was visible externally. At this point, cotton swabs soaked in sterile saline were used to loosen the debris within the umbilical cleft. An approximately 2 centimeter in length mass representing an umbilical concretion was delivered from the umbilical cleft non-invasively. The mass was pearly white with a firm, dark brown cap (Figure 3). The umbilicus was then cleansed and follow up ultrasound scanning showed no residual nodule (Figures 4a and 4b).

DISCUSSION

Umbilical concretions are also known as omphaliths, omphaloliths, omphalokeratoliths, and umboliths. They are a rarely encountered benign entity composed primarily of keratinaceous and sebaceous material which collects within an unusually deep umbilical cleft. While they are infrequently described in the medical literature, their existence has long been recognized and a series of twenty-eight cases was described by Dr. Thomas Cullen in his The Umbilicus and Its Diseases, published in 1916 [1]. On histopathologic examination, umbilical concretions show laminated keratin and

somewhat amorphous sebaceous material, as well as hair and often bacteria. Superficial portions of the concretion which are very firm and dark in color are partially attributable to melanin, likely with a contribution from the oxidation of lipids [2].

Umbilical concretions are generally asymptomatic and affected patients most often seek medical attention only in the face of secondary inflammation or infection. Physicians dating back to Dr. Cullen have implicated lack of attention to umbilical hygiene as a primary risk factor. An umbilical cleft deep enough to contain a significant concretion is also a requirement, and those with an unusually deep umbilical cleft may be especially predisposed. Drs. Ichiki and Kitajima describe a greater than expected frequency in elderly Japanese individuals and suggest an association with the superstition that cleansing of "umbilical sesame" causes abdominal pain [3]. While there is no definitively proven evidence of increased incidence in elderly patients, a majority of reported cases in the literature involve older patients and no cases of pediatric patients have been described to our knowledge. This is likely related to the time required for the formation of a significant concretion. No other clear risk factors and no race or gender predilection have been recognized.

Awareness of the diagnosis of umbilical concretion is important due to the rarity of the condition and the need to differentiate it from other benign and malignant conditions of the umbilicus, including keloid, dermatofibroma, cholesteatoma, malignant melanoma, umbilical endometriosis, primary umbilical malignancy, and umbilical metastasis. The latter is also referred to as a Sister Mary Joseph nodule [2]. Neither a history of indolent painless umbilical mass nor the firmness of the lesion serves to completely exclude other diagnoses. A thorough physical examination followed by the gentle manipulation of an umbilical concretion with moistened swabs, however, usually allows for a definitive diagnosis. The treatment is non-invasive evacuation of the concretion and cleansing of the umbilicus. It should be noted that the presence of associated inflammation or infection, including granuloma formation, may serve to complicate the appearance of the lesion.

Concretions in a deep umbilical cleft may appear deeper and separate from the umbilical orifice. For these reasons, a concretion may easily be confused for a Sister Mary Joseph nodule. The latter is typically described as a subcutaneous, firm, non-tender periumbilical nodule [4]. Radiologists are well aware of the diagnosis of umbilical metastasis, and also recognize that it may be the first, or sometimes the only, sign of an intra-abdominal malignancy. In this case, the consideration of umbilical metastasis lead to the indication for image guided biopsy.

To our knowledge, there is only one prior report of the imaging characteristics of umbilical concretions in the medical literature. Dr. Nittala described the CT and magnetic resonance imaging (MRI) features of two separate cases in a letter to the editor in 2009 [5]. In the first case, a 33 year old male patient underwent abdominal MRI due to pain, swelling, and discharge at the umbilicus. Imaging showed superficial inflammatory changes as well as a well-defined ovoid "signal void" within the umbilicus. As umbilical concretions are composed of devitalized tissue, they should show low signal intensity on all MR sequences. In the second case, an abdominal CT examination showed a rounded, dense lesion (Hounsfield units of 160) within the umbilical cleft of a 40 year old man that was detected incidentally. For this case there is no pathologic description, thus it is unclear if the hyperdense focus represented only a portion of the umbilical concretion or the entire lesion. The presence of hyperdensity on this study correlates with the linear areas of increased attenuation seen in our case, with Hounsfield units measuring up to 266. In our case, however, the majority of the concretion on CT measured soft tissue attenuation with average Hounsfield units of approximately 40. The appearance of the concretion on ultrasound examination is as expected given the nature of the lesion: solid, well circumscribed, somewhat heterogeneous and devoid of vascularity. The more dense superficial areas of the concretion correlate with areas of increased attenuation on CT and likely represent the cause of some associated shadowing. The presence of calcific density on CT is not a reliable indicator of a benign etiology, as umbilical metastases can involve calcification to the extent that it becomes visible upon a radionuclide bone scan [6].

In our case, additional mention must be made of specific imaging features which are of importance given the eventual diagnosis. On the CT examination, review of thin images through the umbilicus demonstrates that the lesion is not entirely subcutaneous as the inferior aspect is contiguous with air at the level of the umbilical orifice. The initial ultrasound examination with images acquired by a sonographer showed a lesion which appeared well marginated and distinct from the umbilical orifice. At real-time sonographic examination, however, the deep portion of the lesion showed clear continuity with the visible external umbilical debris. In both cases, the actual diagnosis was likely elusive primarily because it was not entertained. Dr. Miles Porter reported a case of umbilical concretion treated with surgical excision in the Journal of the American Medical Association in 1920. He noted that a non-invasive treatment would likely have been possible if he had been more familiar with the condition. His analysis concludes with a statement that all physicians have become acquainted with in one form or another: "…there would be little difficulty in establishing the diagnosis in a given case, provided the physician during his examination had in mind the condition [1]."

TEACHING POINT

Umbilical concretion is a rarely encountered benign mass lesion composed of devitalized material which collects within the umbilical cleft. The imaging appearance of concretion is a non-vascular, non-enhancing nodule at the level of the umbilicus. Radiologists should be aware of the diagnosis and its imaging appearance, with particular attention to the importance of differentiating the condition from umbilical metastasis.

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FIGURES

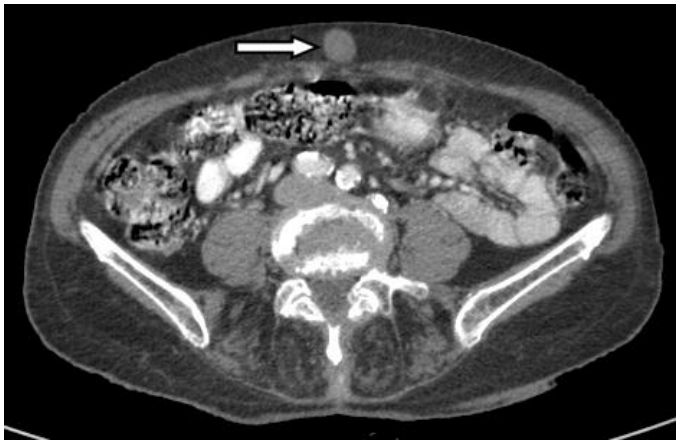

Figure 1a: 85 year old woman with umbilical concretion. Axial contrast enhanced CT of the abdomen and pelvis shows a rounded non-enhancing soft tissue density with well-defined margins within the subcutaneous tissues of the anterior abdominal wall near the level of the umbilicus (arrow). (4.0 mm axial CT reconstruction from a venous phase acquisition at 120 kVp and 223 mAs on a Philips 64-slice scanner following intravenous administration of 100 mL of Isovue-370.)

Figure 1b: 85 year old woman with umbilical concretion. Axial contrast enhanced CT of the abdomen and pelvis shows a rounded non-enhancing soft tissue density with well-defined margins within the subcutaneous tissues of the anterior abdominal wall near the level of the umbilicus (arrow). There is linear calcific density at the most superficial aspect of the lesion (curved arrow). (4.0 mm axial CT reconstruction from a venous phase acquisition at 120 kVp and 223 mAs on a Philips 64-slice scanner following intravenous administration of 100 mL of Isovue-370.)

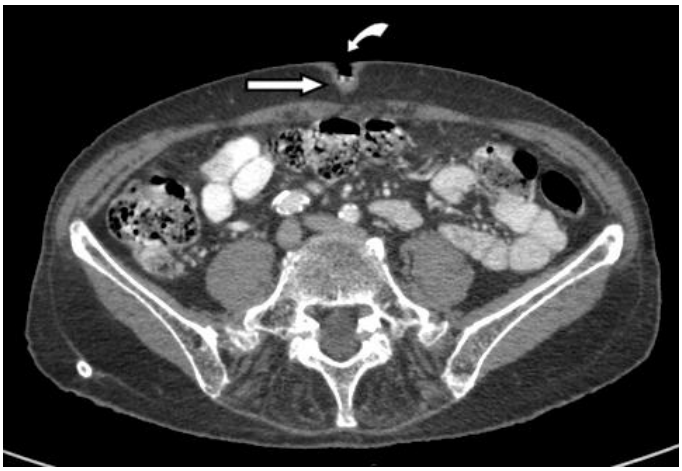

Figure 1c: 85 year old woman with umbilical concretion. Axial contrast enhanced CT of the abdomen and pelvis shows a rounded non-enhancing soft tissue density with well-defined margins within the subcutaneous tissues of the anterior abdominal wall near the level of the umbilicus (arrow). Slightly more inferior slice shows the mass lesion to be directly communicating with air at the level of the umbilical cleft (curved arrow). (4.0 mm axial CT reconstruction from a venous phase acquisition at 120 kVp and 223 mAs on a Philips 64-slice scanner following intravenous administration of 100 mL of Isovue-370.)

Figure 1d: 85 year old woman with umbilical concretion. Coronal image from contrast enhanced CT of the abdomen and pelvis shows a rounded non-enhancing soft tissue density with well-defined margins within the subcutaneous tissues of the anterior abdominal wall near the level of the umbilicus (arrow). (3.0 mm coronal CT reformat from a venous phase acquisition following at 120 kVp and 223 mAs on a Philips 64-slice scanner intravenous administration of 100 mL of Isovue-370.)

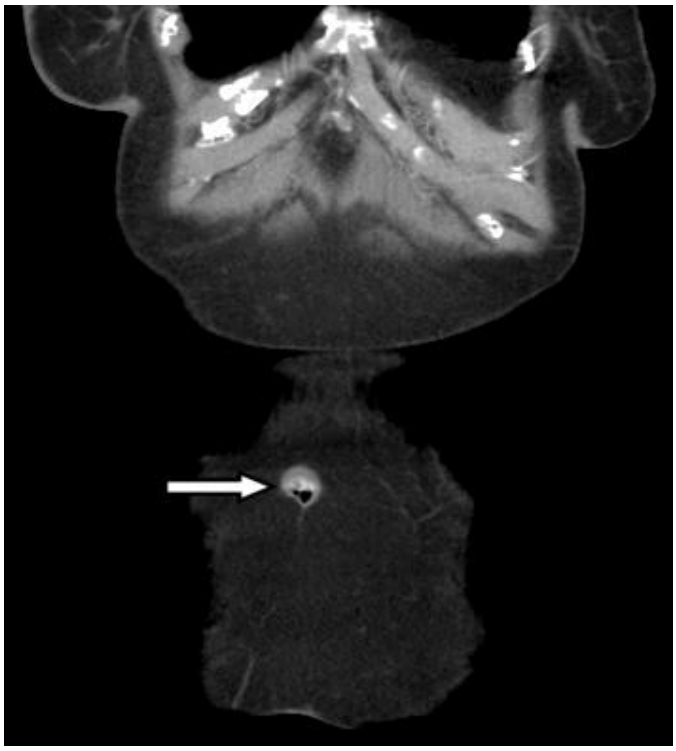

Figure 1e: 85 year old woman with umbilical concretion. Axial contrast enhanced CT of the abdomen and pelvis shows a rounded non-enhancing soft tissue density with well-defined margins within the subcutaneous tissues of the anterior abdominal wall near the level of the umbilicus. Slightly more superficial slice shows the mass lesion to be directly communicating with air at the level of the umbilical cleft (arrow). (3.0 mm coronal CT reformat from a venous phase acquisition at 120 kVp and 223 mAs on a Philips 64-slice scanner following intravenous administration of 100 mL of Isovue-370.)

Figure 2a: 85 year old woman with umbilical concretion. Transverse image from sonographic examination employing color Doppler imaging shows ovoid heterogeneous, predominantly hypoechoic, solid nodule near the level of the umbilicus. The lesion causes some shadowing and there is no intranodular vascularity. (Static image from sonographic examination with linear 12 MHz transducer.)

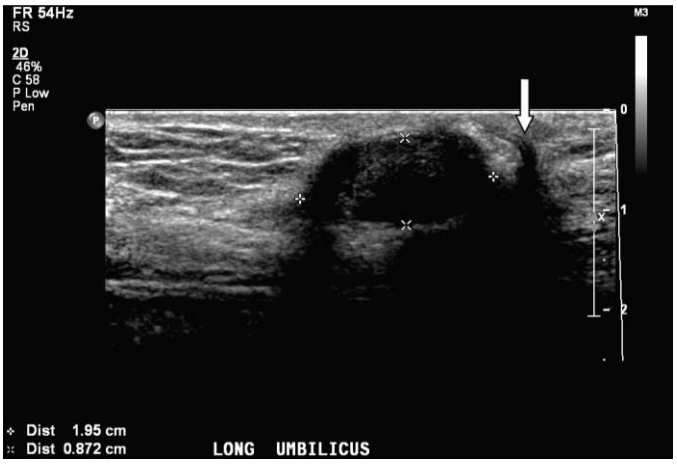

Figure 2b: 85 year old woman with umbilical concretion. Sagittal gray scale image from sonographic examination shows ovoid heterogeneous, predominantly hypoechoic, solid nodule near the level of the umbilicus. The hypoechoic curvilinear structure inferior to the nodule likely represents part of the deep umbilical cleft (arrow). (Static image from sonographic examination with linear 12 MHz transducer.)

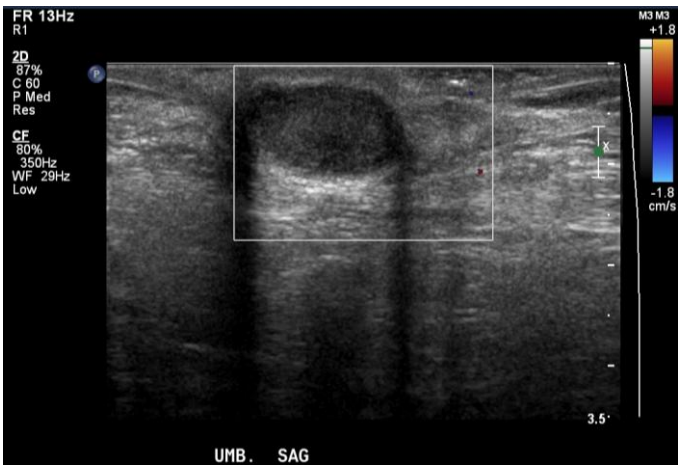

Figure 2c: 85 year old woman with umbilical concretion. Follow up ultrasound imaging for biopsy planning. Transverse image from sonographic examination employing color Doppler imaging shows no change of the ovoid heterogeneous, predominantly hypoechoic, solid nodule near the level of the umbilicus. There is no intranodular vascularity. (Static image from sonographic examination with linear 12 MHz transducer.)

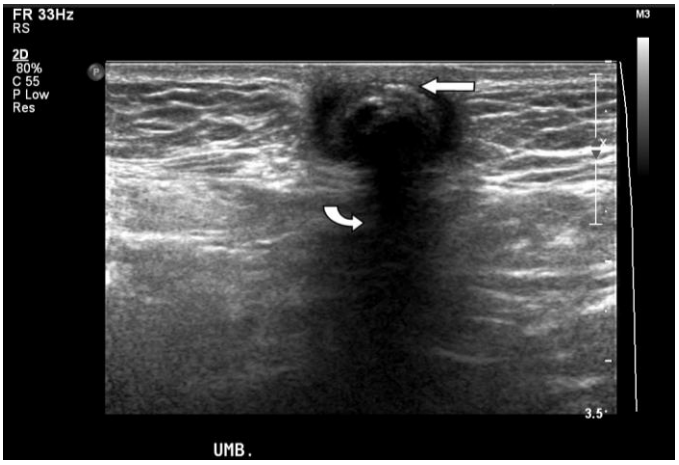

Figure 2d: 85 year old woman with umbilical concretion. Follow up ultrasound imaging for biopsy planning. Transverse gray scale image from sonographic examination shows ovoid heterogeneous, predominantly hypoechoic, solid nodule near the level of the umbilicus. There is linear hyperechogenicity (arrow) causing shadowing (curved arrow) which correlates with the linear calcific density seen on CT examination. (Static image from sonographic examination with linear 12 MHz transducer.)

Figure 3: The evacuated umbilical concretion measured approximately 2 centimeters in length. The concretion was predominantly soft and pearly white, with a very firm dark brown cap which was visible upon physical exam.

Figure 4a: 85 year old woman with umbilical concretion. Follow up ultrasound imaging. Transverse gray scale image from sonographic examination shows no residual abnormality post non-invasive evacuation of umbilical concretion. Ultrasound transmission gel fills the deep umbilical cleft (arrow). (Static image from sonographic examination with linear 12 MHz transducer.)

Figure 4b: 85 year old woman with umbilical concretion. Follow up ultrasound imaging. Transverse gray scale image from sonographic examination shows no residual abnormality post non-invasive evacuation of umbilical concretion. Ultrasound transmission gel fills the deep umbilical cleft. (Static image from sonographic examination with linear 12 MHz transducer.)

Etiology	Umbilical concretions consist of devitalized sebaceous and keratinaceous material which collects within a deep umbilical cleft
Incidence	Rare, with exact incidence undetermined
Gender ratio	No male or female predominance
Age predilection	More common in elderly patients
Risk factors	Unusually deep umbilical cleft, lack of attention to umbilical hygiene
Treatment	Non-invasive evacuation of concretion and cleansing of umbilical cleft
Prognosis	Excellent
Findings on imaging	US: Well circumscribed, solid, hypoechoic mass within umbilical cleft. No vascularity on Doppler imaging. May cause acoustic shadowing. CT: Non-enhancing soft tissue attenuation mass. Dense superficial component may show areas of calcium attenuation. MRI: Hypointense on all pulse sequences.

Table 1. Summary table for umbilical concretion

	US	CT	MRI
Umbilical Concretion	Well circumscribed, solid, heterogeneous but predominantly hypoechoic nodular mass within the umbilical cleft. No vascularity on Doppler imaging. Portions may cause acoustic shadowing.	Non-enhancing soft tissue attenuation mass. Dense superficial component may show areas of calcium attenuation.	Hypointense on all pulse sequences.
Dermatofibroma[7]	Well circumscribed, solid homogeneously hypoechoic subcutaneous nodule. May show vascularity on Doppler imaging.	Well circumscribed soft tissue attenuation subcutaneous nodule.	
Umbilical metastasis[8,9]	Variable, may be dermal, subcutaneous, or peritoneal. Mass may be solid or cystic with solid components	Variable, may be dermal, subcutaneous, or peritoneal. Soft tissue attenuation or cystic lesion with soft tissue component. +/- enhancement after contrast administration.	Limited data in literature. Report of low T1 and T2 signal intensity with enhancement following gadolinium administration.
Primary umbilical malignancy	Similar to umbilical metastasis	Similar to umbilical metastasis	Similar to umbilical metastasis
Umbilical endometriosis[10]	Hypoechoic mass with vascularity on Doppler imaging.	Soft tissue attenuation mass.	Variable, may show hyperintense signal on T1 imaging related to blood products. Reports of hypointense T1 and T2, hypointense T1 and hyperintense T2, hypointense T1 and heterogeneous T2.
Malignant melanoma, keloid, cholesteatoma	Not typically imaged.		

Table 2. Differential diagnosis table for umbilical concretion

ABBREVIATIONS

CT : Computed tomography.
MRI: Magnetic resonance imaging

KEYWORDS

Umbilical concretion; omphalith; omphalolith; umbolith