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ORIGINAL ARTICLE

Layering of stomach contents in drowning cases in post-mortem computed tomography compared to forensic autopsy

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Abstract

Background In forensic autopsy, the analysis of stomach contents is important when investigating drowning cases. Three-layering of stomach contents may be interpreted as a diagnostic hint to drowning due to swallowing of larger amounts of water or other drowning media. The authors experienced frequent discrepancies of numbers of stomach content layering in drowning cases between post-mortem computed tomography (PMCT) and autopsy in forensic casework. Therefore, the goal of this study was to compare layering of stomach contents in drowning cases between PMCT and forensic autopsy.

Methods Drowning cases ($n = 55$; 40 male, 15 female, mean age 45.3 years; mean amount of stomach content 223 ml) that received PMCT prior to forensic autopsy were retrospectively analyzed by a forensic pathologist and a radiologist. Number of layers of stomach content in PMCT were compared to number of layers at forensic autopsy.

Results In 28 of the 55 evaluated drowning cases, a discrepancy between layering of stomach contents at autopsy compared to PMCT was observed: 1 layer at autopsy ($n = 28$): 50% discrepancy to PMCT, 2 layers ($n = 20$): 45% discrepancy, and 3 layers ($n = 7$): 71.4% discrepancy. Sensitivity of correctly determining layering (as observed at forensic autopsy) in PMCT was 52% (positive predictive value 44.8%). Specificity was 46.6% (negative predictive value 53.8%). In a control group ($n = 35$) of non-drowning cases, three-layering of stomach contents was not observed.

Conclusion Discrepancies of observed numbers of stomach content layers between PMCT and forensic autopsy are a frequent finding possibly due to stomach content sampling technique at autopsy and movement of the corpse prior to PMCT and autopsy. Three-layering in PMCT, if indeed present, may be interpreted as a hint to drowning.

Keywords Post-mortem computed tomography · Drowning · Stomach contents · Layering · Discrepancy · Wydler's sign

Abbreviations

FN	False negative
FP	False positive
HU	Hounsfield unit
kV	Kilovolt
ms	Milliseconds
NPV	Negative predictive value
PMCT	Post-mortem computed tomography
PMI	Post-mortem interval
PPV	Positive predictive value
TN	True negative
TP	True positive

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Introduction

Post-mortem computed tomography (PMCT) has become part of routine forensic examinations and is meanwhile accepted as a useful adjunct to forensic autopsy at forensic institutes worldwide [1, 2]. Drowning cases are part of routine forensic examinations. At forensic autopsy, macroscopic findings as hemodilution, pulmonary edema, subpleural hemorrhages (Paltauf 's spots), a lower spleen weight, gross hemorrhages in the temporal bone, aqueous liquid in the frontal, ethmoidal, maxillary, and sphenoidal sinuses or lacerations of the gastric mucosa (Sehrt's sign) may hint to drowning as the cause of death. Moreover, there are unspecific microscopic findings such as acute lung emphysema with over dilatation of the

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alveoles, thinning or lacerations of the septa, capillary congestion, intraalveolar edema, and hemorrhages that may be found in drowning cases [3–8]. Unspecific findings at PMCT such as fluid in the paranasal sinuses, fluid materials in the airways, and groundglass opacities of the lungs have been described as typical PMCT findings in drowning cases [9–18]. So far, only little attention has been given to layering of stomach contents at PMCT. At forensic autopsy, the analysis of stomach content layering is important when investigating drowning cases. Layering of stomach contents may be interpreted as a diagnostic hint to drowning due to swallowing of larger amounts of water or other drowning media. Particularly, a three-layering of stomach contents, the so-called Wydler's sign, may be interpreted as a strong diagnostic hint to drowning. At forensic autopsy, such three-layering typically shows an upper layer consisting of frothy material due to a mix of drowning fluid medium and protein rich tracheo-bronchial mucus released at the actual process of drowning, a medium layer consisting of fluid materials, and a lower layer consisting of denser components [3, 4]. However, none of the few existing PMCT drowning studies further investigated stomach content layering. In their forensic practice, the authors noticed frequent discrepancies between stomach content layering observed at PMCT and layering observed at forensic autopsy in drowning cases. For forensic pathologists and forensic radiologists, it is of importance to know discrepancies between autopsy and PMCT for a correct interpretation of specific case findings [19]. Therefore, the goal of the present study was to evaluate differences of stomach content layering in PMCT compared to forensic autopsy.

Methods

Study population

The study design was retrospective. The study group consisted of $n = 55$ drowning cases (40 male, 15 female, mean age 45.3 years). All cases underwent post-mortem computed tomography prior to forensic autopsy between the years 2005 and 2017. Inclusion criterion for the study group was drowning as cause of death according to autopsy reports. All study group cases were freshwater drownings due to the author's institute's regional location with only non-saltwater inshore waters. The postmortem interval (PMI, time between death and autopsy) ranged from 1 day to 3 months.

A control group consisted of 35 randomly chosen non-drowning forensic autopsy and PMCT cases examined prospectively at the author's host institute (mean age 52.3 years, 19 males, 16 females) between December 2017 and March 2018. Inclusion criteria for the control group were non-trauma cases with intact upper gastro-intestinal system. The postmortem interval of control cases ranged from 1 day to 2 months.

PMCT scanning

Two CT scanners were used: a Somatom Emotion 6 (Siemens, Forchheim, Germany) and a Somatom Definition AS 64 (Siemens, Forchheim, Germany). CT scan parameters for the Somatom Emotion 6 were as follows: beam energy 130 kV; rotation time 1500 ms; Collimation 6×1 mm; image reconstructions with slice thickness of 1.25 mm, increment of 0.7 mm, soft tissue kernel (B30), bone kernel (B70), and lung kernel (B70); field of view was adapted to the size of the object (field of view for lung kernel was adapted to the dimensions of the thorax). CT scan parameters for the Somatom Definition AS 64 were as follows: beam energy 130 kV collimation 64×0.6 mm; rotation time 500 ms; image reconstructions for both CT scanners were performed with a slice thickness of 1.0 mm and an increment of 0.7 mm using a soft tissue kernel (I31f), bone kernel (I70f), and lung kernel (I70f); and the field of view was adapted to the size of the object (field of view for lung kernel was adapted to the dimensions of the thorax).

Before PMCT, corpses were stored in cooling chambers in supine position on metal stretchers for several hours. For PMCT scanning, corpses were placed in body bags in supine position and transferred from the stretcher to the CT table. Transfer was conducted by autopsy technicians who manually moved the body bag horizontally from the stretcher onto the CT table. Before the movement of the body bag, the height of the CT table was adjusted to the height of the stretcher. PMCT scans were performed in supine corpse position without the usage of contrast agent a few minutes after positioning the corpse on the CT table. All PMCT scans were conducted prior to forensic autopsy. After PMCT, corpses in body bags were moved from the CT table to a stretcher and transported to the autopsy room. In the autopsy room, corpses were transferred from the stretcher to the autopsy table. Transfer was conducted by autopsy technicians who manually moved the corpse horizontally from the stretcher onto the autopsy table. Before the movement of the corpse, the height of the stretcher was adjusted to the height of the autopsy table. The time interval between completion of PMCT and start of forensic autopsy (that always started with the external examination of the corpse) was approximately 30–60 min. Use of the imaging data was approved by the local ethics committee.

Forensic autopsy

Forensic autopsies were ordered by the local authorities. Autopsies were performed by board certified forensic pathologists immediately after PMCT. External and internal examination of corpses was performed according to the

Recommendation of the Committee of Ministers to Member States of Europe on the harmonization of medico-legal autopsy rules [20]. External examination included turning the corpse to prone position for examination of the backside. All three body cavities were opened and all organs were dissected. The stomach was opened in situ along the greater curvature. In drowning cases or cases suspicious of drowning, stomach content was ladled out completely from the stomach in situ and put into a transparent measuring cup (Fig. 1). Stomach contents were left to set in the measuring cup for at least 20 min and evaluated for quantity, composition, and (if present) layering, which was noted in the autopsy report. Digital photographs of the measuring cup were taken and added to a case photo database. The procedure of transferring stomach contents entirely to a transparent measuring cup and being let still for at least 20 min was not conducted in non-drowning (control group) cases. In such cases, only quantity and composition of stomach content was noted in autopsy reports.

PMCT image analysis and HU value measurements

Stomach contents were evaluated in PMCT images in multiplanar mode using a commercially available PACS (Sectra Workstation IDS7, 2015 Sectra AB Sweden) with soft tissue kernels and bone kernels. Evaluation of stomach content was conducted blinded to the autopsy results by a board certified radiologist experienced in post-mortem imaging in consensus with a board certified forensic pathologist. Stomach content was evaluated for visible sedimentation and layering based on different image contrasts (Fig. 1). HU values of stomach content layers were obtained by creating a total of five independent and non-overlapping square regions of interest (ROIs) in each visible layer separately in axial or sagittal PMCT images. The ROIs were placed over the entire ventro-dorsal expansion of stomach content layers. The sizes of the ROIs depended on the extensions of layers but were at least 4 mm in each dimension. In case where no layering was visible, ROIs were placed over the whole ventro-dorsal extension of stomach contents.

Stomach content layering in PMCT compared to forensic autopsy

Autopsy reports and photographs of the study group were evaluated for stomach content layering. This evaluation was performed by one observer blinded to the PMCT results. Afterwards, the results from the autopsy were compared with those from the PMCT image analysis. Stomach content appearance according to autopsy reports and photographs was determined as gold standard. PMCT findings were compared to autopsy findings according to the following parameters: true positive (TP): 2 (or 3) layers at autopsy and PMCT; false positive (FP): more layers at PMCT than at autopsy; true negative (TN): only one layer at autopsy and PMCT; and false negative (FN): 2 or 3 layers at autopsy, lesser number of layers at PMCT. Sensitivity, specificity, positive predictive value (PPV) and negative predictive value (NPV) with 95% confidence intervals (CI) were calculated. SPSS® (Version 23.0) was used to perform a series of one-way Welch F-test ANOVAs with post-hoc analysis to evaluate HU values of stomach content layers between drowning (study group) cases among each other and control (control group) cases and drowning cases (study group). Total volumes of stomach contents were compared between study group and control group with independent *t* tests (p values < 0.05 were considered to be significant).

Results

Table 1 gives information about age, sex, post-mortem interval, stomach content volume and composition of stomach content at autopsy, and numbers of stomach content layers observed at autopsy and PMCT in all investigated 55 drowning (study group) cases. All but one case (No. 43 in Table 1) of the study group showed stomach contents (mean amount of stomach content 245 ± 229 ml) at forensic autopsy. Mean stomach content of the control group was 209 ± 201 ml. *T* testing showed no significant difference ($p = 0.06$) between stomach content volume of the study group and the control group. Stomach content in drowning cases showed either one (50.9%), two (34.5%), or three (12.7%) layers at autopsy. In PMCT also, either one (41.8%), two (40%), or three (18.2%) layers were observed in the study group.

If there was layering observed at forensic autopsy, the lower layer always showed denser materials than the upper (fluid) layer. In PMCT, upper layers always appeared more hypodense than lower layers. In cases with three layers of stomach contents, the third (uppermost) layer always consisted of frothy material both at autopsy and PMCT. Only one or two layers were visible in control cases (single-case data not shown) at PMCT; none of the control cases exhibited three layers of stomach content at PMCT. In cases with three layers, the lung kernel was most feasible for depiction of the uppermost frothy layer while the soft tissue kernel was most feasible for depiction of the lower layers.

Table 2 shows that frequent discrepancies of numbers of layers of stomach contents were observed between autopsy and PMCT (Fig. 2). In 28 of the 55 evaluated drowning cases of the study group, a discrepancy between layering of stomach contents at autopsy compared to PMCT was observed: 1 layer at autopsy ($n = 28$): 50% discrepancy to PMCT, 2 layers ($n = 20$): 45% discrepancy, and 3 layers ($n = 7$): 71.4%

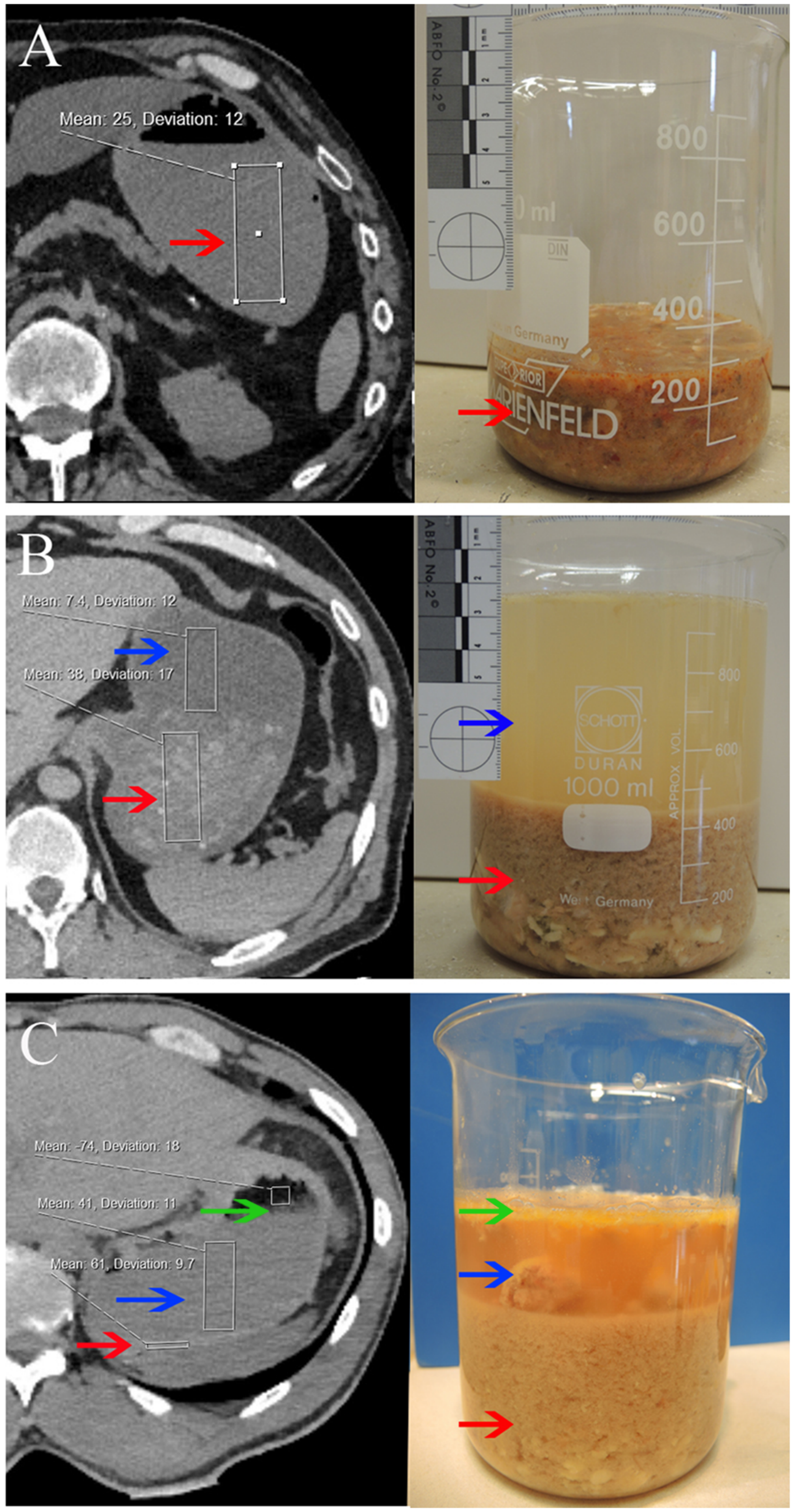

Fig. 1 Comparison of stomach content layering in PMCT vs forensic autopsy in drowning cases. At PMCT, stomach content was evaluated for visible sedimentation and layering based on different image contrasts. HU values of stomach content layers were obtained by creating regions of interest (ROIs) in each visible layer separately. The figure shows cases with matching layer numbers between PMCT and forensic autopsy for one (**a**, case no. 4 in Table 1), two (**b**, case no. 6), and three (**c**, case no. 42) layers of stomach content

discrepancy. Sensitivity of correctly determining layering (as observed at forensic autopsy) in PMCT was 52% (positive predictive value 44.8%). Specificity was 46.6% (negative predictive value 53.8%).

Table 3 gives PMCT HU values evaluated for the different stomach content layers in drowning and control (control group) cases. ANOVA testing showed that in drowning cases with three layers of stomach content, significant differences

Table 1 Information acquired at autopsy and PMCT in all investigated 55 drowning (study group) cases

Case. no.	Age (years)	Sex	PMI (d)	Stomach content volume autopsy	Composition stomach content autopsy	No. stomach content layers autopsy	No. stomach content layers PMCT	HU PMCT lower (or single) layer	HU PMCT middle (or upper of two) layer	HU PMCT upper (third) layer
1	69	m	5	600	Fluid	1	1	21	–	–
2	13	w	1	20	Fluid	1	1	35	–	–
3	34	m	1	80	Solid	1	1	− 24	–	–
4	66	m	14	300	Fluid	1	1	33	–	–
5	27	m	1	100	Solid, fluid	2	2	21	5	–
6	26	m	1	450	Solid, fluid	2	2	10	4	–
7	32	m	1	100	Paste-like	1	3	30	22	− 25
8	24	m	1	50	Fluid	1	2	40	25	–
9	50	f	1	100	Paste-like	1	3	30	25	− 23
10	36	m	1	60	Fluid	1	2	20	15	–
11	55	f	4	200	Fluid	1	1	4	–	–
12	14	m	5	400	Solid	1	1	12	10	–
13	74	m	1	50	Fluid	1	1	− 9	–	–
14	54	w	1	50	Fluid	1	1	40	–	–
15	18	m	3	600	Solid	1	3	70	60	30
16	34	m	2	10	Fluid	1	1	26	–	–
17	2	m	4	100	Fluid	1	3	20	− 2	14
18	52	m	9	350	Solid, fluid	2	2	40	33	–
19	85	m	3	280	Solid, fluid	2	1	− 5	–	–
20	59	m	17	50	Fluid	1	2	20	5	–
21	26	m	60	20	Fluid	1	1	30	–	–
22	1.1	m	1	200	Solid	1	3	70	40	− 20
23	37	m	1	50	Solid	1	1	15	–	–
24	54	m	4	50	Fluid	1	2	28	9	–
25	43	w	2	150	Solid	1	1	23	–	–
26	60	m	3	20	Fluid	2	2	− 25	− 37	–
27	57	m	2	250	Solid, fluid, frothy	3	1	− 11	–	–
28	76	m	3	250	Solid, fluid	2	1	− 5	–	–
29	20	w	2	50	Fluid	1	1	20	–	–
30	48	m	3	50	Solid, fluid, frothy	3	2	80	50	–
31	57	m	1	220	Fluid	2	2	− 4	− 20	–
32	44	m	30	250	Fluid	1	2	70	30	–
33	87	w	1	100	Solid, fluid	2	2	10	− 6	–
34	30	m	7	50	solid, fluid	2	2	30	− 120	–
35	20	m	4	350	Solid, fluid, frothy	3	2	10	3	–
36	27	m	5	750	Solid, fluid	2	3	30	5	− 18
37	21	m	10	400	Solid, fluid	2	1	20	–	–
38	73	m	1	900	Solid, fluid	2	3	50	3	− 12
39	18	m	15	70	Paste-like	2	2	22	11	–
40	26	m	13	850	Paste-like	1	2	25	22	–
41	60	f	8	100	Paste-like	1	1	25	–	–
42	67	m	6	300	Solid, fluid, frothy	3	3	50	35	33
43	66	f	90	0	n/a	0	1	5	–	–
44	75	m	10	300	Solid, Fluid, frothy	3	2	6	1	–
45	Unknown	m	3	200	Solid, fluid, frothy	3	1	17	–	–
46	27	m	4	100	Mucous	1	3	19	15	1
47	44	m	1	150	Solid, fluid, frothy	3	3	49	33	8
48	84	m	1	110	Fluid	1	2	7	− 4	–
49	79	m	20	100	Solid, fluid	2	1	22	–	–
50	30	m	13	200	Solid, Fluid	2	1	8	–	–
51	41	m	3	300	Solid, fluid	2	2	23	14	–
52	57	m	3	750	Solid, fluid	2	2	41	15	–
53	15	m	2	400	Solid, paste-like	2	2	20	17	–
54	73	m	1	450	Solid	1	2	− 9	− 13	–
55	55	m	1	750	Solid, fluid	2	1	2	–	–

Case information of all investigated 55 drowning cases including numbers of observed stomach content layers at autopsy and PMCT as well as HU values of stomach content layers in PMCT

between radiodensities of all layers among each other were present (Table 4). When there was only one layer of stomach content, HU values of drowning cases were significantly lower than in control cases.

Table 2 Frequent discrepancies of numbers of layers of stomach contents between autopsy and PMCT

	TP (2 (or 3) layers at autopsy and PMCT)	FP (more layers at PMCT than at autopsy)	TN (only one layer at autopsy and PMCT)	FN (2 or 3 layers at autopsy, smaller number of layers at PMCT)	Sensitivity in %	Specificity in %	PPV in %	NPV in %
Layering Autopsy vs PMCT ($n = 55$)	13	16	14	12	52	46.6	44.8	53.8

Results of comparison between observed numbers of stomach content layers in autopsy and PMCT in 55 drowning cases. Note that there are low sensitivity and specificity as well as low positive and negative predictive values (*TP* true positive, *FP* false positive, *TN* true negative, *FN* false negative, *PPV* positive predictive value, *NPV* negative predictive value)

Discussion

The results of the present study indicate that discrepancies of observed numbers of stomach content layering between PMCT and forensic autopsy are a frequent finding. Forensic radiologists and forensic pathologists should be aware that appearance of stomach content layering in drowning cases may differ between PMCT and forensic autopsy. This has direct consequences for case interpretation since a three-layering may be interpreted as a strong hint to drowning. Reasons for the observed relatively high discrepancy rate may be movement of the corpse prior to PMCT and autopsy. For CT scanning, corpses have to be moved from a stretcher to the CT table. This transfer is usually done manually by dragging the corpse or the body bag from the stretcher to the CT table. This may result in a rapid horizontal movement of the corpse. This movement may lead to a resuspension of priory layered stomach content. Since CT scan is usually conducted shortly after the corpse was placed on the CT table, the PMCT image may depict the resuspension of stomach content. Usually, an external examination of the corpse is part of routine forensic autopsy. In the course of the external examination, the body is turned to examine the backside. Hereby stomach content may flow out of the nose and mouth, which may alter later analysis and comparisons. Moreover, PMCT appearance of stomach contents cannot be directly compared to the in situ situation at forensic autopsy. When dissecting the stomach, it is not possible to judge content layering in situ since a wider opening of the stomach would result in running off of contents into the abdominal cavity. Therefore, the stomach has to be slightly opened, and contents have to be transferred into a transparent jar with a ladle [3, 4]. This transfer may alter the later development of layering. Thus, the sampling technique at autopsy may partially explain differences to PMCT. In the current study, none of the cases of the non-drowning control group showed a three-layering of stomach contents. Only one or two layers of stomach contents were observed in the control group in PMCT. Three-layering in PMCT was only observed in drowning cases. Hence, three-layering but not one or two layering of stomach contents in PMCT may strengthen the forensic drowning diagnosis. However, the results of the present study indicate a low

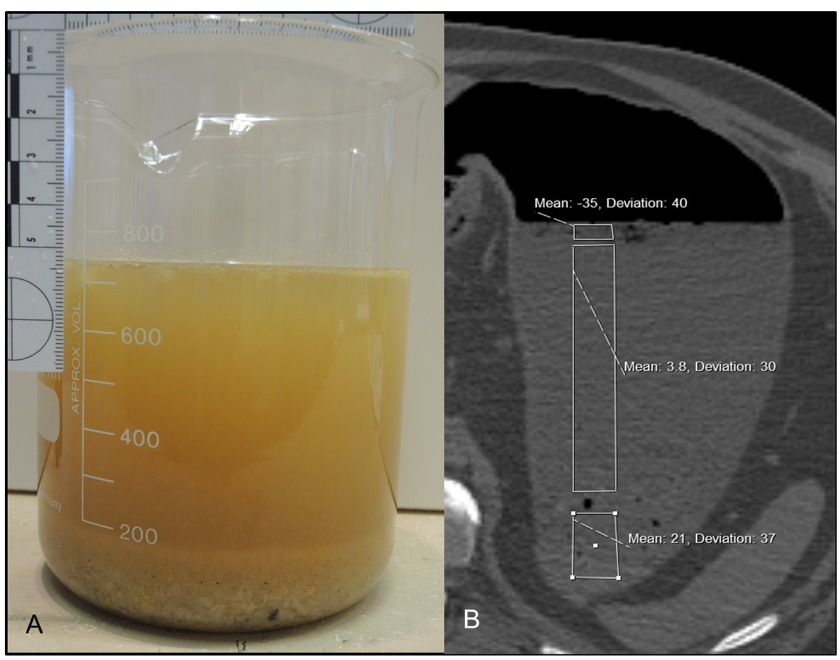

Fig. 2 Exemplary demonstration of discrepancy of stomach content layers between PMCT and autopsy. In this case (no. 36 in Table 1) two layers of stomach content (solid lower layer and fluid upper layer) were observed at autopsy (**a**) while PMCT showed three layers (**b**) with an upmost frothy layer exhibiting negative HU values

Table 3 PMCT HU values evaluated for the different stomach content layers in drowning and control (control group) cases

	n	Mean HU	Standard deviation	Min - Max HU
Drowning one layer	21	11.24	17.68	(−)24–40
Control one layer	22	20.59	10.63	(−)5–50
Drowning 2 layers /lower layer	22	11.43	30.05	(−)70–80
Drowning 2 layers /upper layer	22	8.04	32.59	(−)120–50
Control 2 layers/lower layer	13	27.92	14.65	5–50
Control 2 layers upper layer	13	(−)5.23	35.1	(−)100–30
Drowning 3 layers /lowest layer	11	39.18	17.58	14–70
Drowning 3 layers /middle layer	11	25.09	22.23	(−)5–70
Drowning 3 layers /upper layer	11	(−)2	20.8	(−)25–33

Calculated means, standard deviations and ranges of measured PMCT HU stomach content values in 55 drowning cases and 35 non-drowning control cases. HU values are shown for each layer. Three-layering was not observed in the control group

sensitivity of approximately 50% for PMCT in correctly identifying a three-layering of stomach contents in drowning cases compared to forensic autopsy as gold standard. Therefore, in cases with the absence of three-layering in PMCT, drowning must not be excluded. The results also showed a low specificity/true negative rate of PMCT compared to forensic autopsy as gold standard. In approximately 50% of cases in which three-layering was visible at PMCT, less layers were observed at forensic autopsy. This observation indicates that forensic autopsy may frequently fail to recognize a three-layering present in situ at the non-dissected stomach. Alteration of stomach contents due to transfer of contents to a jar and movement of the corpse at autopsy and prior to PMCT as discussed above may explain differences between the PMCT in situ and autopsy ex situ appearance of stomach content layering.

Table 4 ANOVA testing showing significant differences between radiodensities of all layers

	p value
Drowning one layer - Control one layer	0.019*
Drowning 2 layers/lower layer - Control 2 layers/lower layer	0.003*
Drowning 2 layers/upper layer - Control 2 layers/upper layer	0.04*
Drowning 2 layers/lower layer - Drowning 2 layers/upper layer	0.71
Drowning 3 layers/lower layer - Drowning 3 layers/middle layer	0.013*
Drowning 3 layers/lower layer Drowning 3 layers/upper layer	< 0.001*
Drowning 3 layers/middle layer - Drowning 3 layers/upper layer	< 0.001*

ANOVA testing of PMCT HU stomach content layer values of 55 drowning cases compared to 35 non-drowning control cases. Testing was also conducted between different layers in drowning cases. Note that in drowning cases with three layers, significant differences between radiodensities of all layers among each other were present. *Three-layering was not observed in the control group

So far, less than 20 PMCT drowning studies have been conducted [9–18]. Concerning stomach findings, mostly distension of the stomach due to swallowing of larger amounts of fluid media has been described as a possible radiologic finding in drowning [9, 10, 16]. Only one study from Vander Plaetsen et al. described layering of stomach contents in PMCT, which occurred at 27% of their drowning study cases [16]. In our study, three-layering of stomach contents in 55 cases was observed in 13% at autopsy and 18% at PMCT. Hence, it can be concluded that three-layering of stomach contents, the so-called Wydler's sign, is a relatively rare finding in drowning cases.

Vander Plaetsen et al. measured the mean density of the stomach content by placing a region of interest (ROI) into the homogenous fluid component, which was 20 HU. Van Hoyweghen et al. and Christe et al. measured mean stomach content radiodensities in the middle of the stomach of 16 HU and 20 HU respectively in their drowning cases [9, 10]. None of the forenamed three studies conducted measurements in different layers of drowning stomach contents. Our results show that when three layers appear, they exhibit significantly different radiodensities and HU values respectively. Thus, HU measurements conducted in different levels of stomach contents might help in determining different layers in PMCT drowning cases. In cases with layering in PMCT images, the Wydler's sign can be detected easily [3, 4]. However, the results of the present study indicate that there are cases in which three-layering is ambiguous in PMCT. In such cases, HU measurements in different levels of stomach content may help in determination of layer numbers. If an uppermost third frothy layer was present in our study cases, it presented with a relatively slim layer thickness between a few millimeters to approximately 1.5 cm. Despite of relatively slim layer thickness, HU measurements were possible in all cases with frothy layers. However, in cases with uppermost slim frothy layers, the radiologic observer has to be careful that ROIs do not overlap with the adjacent downer layer and the adjacent free gas within the stomach.

The present study has some noteworthy limitations:

Case numbers of the present study were relatively small but still allowed for statistical analysis. However, case numbers of previous studies were smaller with only one study having more than 50 drowning cases.

All drowning cases were freshwater cases. Whether saltwater drowning may affect layering of stomach content at PMCT and autopsy due to different chemical water composition remains unknown.

Conclusion

Discrepancies of observed numbers of stomach content layering between PMCT and forensic autopsy are a frequent finding possibly due to stomach content sampling technique at autopsy and movement of the corpse prior to PMCT and autopsy. Three-layering in PMCT, if indeed present, may be interpreted as a hint to drowning.

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