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Diagnostic value of multiphase postmortem computed tomography angiography in selected cases of blunt traumatic deaths

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ABSTRACT

Objectives: Recently, multiphase postmortem computed tomography angiography (MPMCTA) has been proven as a reliable tool in the diagnosis of vascular pathology, while its potential efficiency in the detection of soft tissue lesions is ignored. In this study, we have evaluated the overall diagnostic value of MPMCTA in the diagnosis of blunt traumatic deaths in selected cases to determine its additional advantages and limitations in order to identify its potential applications.

Methods: This prospective study examined 14 decedents presented to the Department of Legal Medicine of Hamburg University that alleged death due to blunt trauma. For each case, MPMCTA and conventional autopsy findings were compared. Both radiological and autopsy findings are divided according to the body regions in addition to the detection of the cause of death.

Results: Both MPMCTA and the conventional autopsy showed the major findings but not all findings. MPMCTA was better in the demonstration of vascular and skeletal lesions, while the diagnosis of parenchymal injury remains autopsy-dependent. The efficiency of MPMCTA for detection of haemorrhage was relatively affected by the blood amount and the location of the bleeding source. The presented MPMCTA-related artefacts interfered with the accurate diagnosis of certain injuries.

Conclusion: The combination of MPMCTA with conventional autopsy appears to be the gold standard for investigation of blunt traumatic deaths. Depending on the death circumstances and the expected findings, MPMCTA can be performed alone in selected cases.

1. Introduction

Recently, postmortem computed tomography [PMCT] has been applied routinely in several forensic centres, especially for the examination and documentation of traumatic deaths. PMCT is a fast, easy, relatively low-cost technique that does not affect or damage the basic forensic evidence [1–3]. However, PMCT showed some limitations in the assessment of vascular and parenchymal pathologic abnormalities [4]. To overcome these limitations, injection of a contrast material is suggested to enhance the visualisation in a minimally invasive manner [5,6].

In 2008, multiphase postmortem angiography [MPMCTA] was a novel technique introduced by Grabherr et al. With a perfusion device, the postmortem circulation can be established, and the contrast material is injected according to a triphasic angiographic protocol. Because of its promising results, some forensic centres have been encouraged to use this standardised technique [7,8]. Unfortunately, MPMCTA was reported in publications that mainly focused on its accuracy in the detection of vascular lesions, ignoring its potential efficiency in the detection of soft tissue and skeletal lesions [9–11]. Therefore, overall MPMCTA diagnostic value is still in question.

In 2013, Chevallier et al. and Dedouit et al. compared the performance of MPMCTA to conventional autopsy in traumatic deaths. Their studies demonstrated several advantages and limitations of each technique regarding the detection of specific lesions [12,13]. Consequently, the diagnostic ability differences of both techniques should be well understood to accurately identify the different lesions and to outline the indications for each technique [12]. The hypotheses based on those

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Table 1
Characteristics of the examined cases and the findings detected by MPMCTA and the conventional autopsy.

Case No.	Gender	Age (in years)	Postmortem Interval to MPMCTA scan (in days)	Death Circumstances	Findings detected by MPMCTA and Autopsy	Findings detected by Autopsy alone	Findings detected by MPMCTA alone
1	Male	59	6	Traffic accident	Subarachnoid hematoma, splenic and bowel lacerations, hemothorax, hemoperitoneum, retroperitoneal hemorrhage, small vessel rupture, facial, skull, thoracic cage, upper limbs and lower limbs fractures	Pulmonary laceration, renal laceration	Intracerebral hematoma
2	Male	49	4	Traffic accident	Epidural hematoma, subdural hematoma, subarachnoid hematoma, intracerebral hematoma, skull, lower limbs and pelvic fractures		Pulmonary laceration
3	Male	62	3	Fall from height	Hemothorax, pulmonary laceration, hepatic and splenic lacerations, hemoperitoneum, retroperitoneal hemorrhage, aortic rupture, small vessel rupture, facial, thoracic cage, vertebral and upper limbs fractures	Renal laceration	Bowel laceration, pelvic fracture
4	Male	75	2	Fall from height	Epidural hematoma, subarachnoid hematoma, intracerebral hematoma, hemothorax, thoracic cage and lower limbs fractures	Subdural hematoma, pulmonary laceration	Hemoperitoneum, vertebral fracture
5	Female	10	5	Traffic accident	Hemothorax, pulmonary laceration, thoracic cage fracture	Splenic laceration	Vertebral fracture
6	Male	49	5	Fall from height	Intracerebral hematoma, hemothorax, hemoperitoneum, pulmonary laceration, aortic rupture, small vessel rupture, skull, thoracic cage, lower limbs, pelvic and vertebral fractures	Hepatic laceration	Facial fracture
7	Male	35	2	Traffic accident	Subarachnoid hematoma, hemothorax, hemoperitoneum, pulmonary laceration, hemopericardium, hepatic and splenic lacerations, aortic rupture, small vessel rupture, skull, thoracic cage and pelvic fractures	Bowel laceration	
8	Female	67	3	Traffic accident	Hepatic, splenic and bowel lacerations, hemoperitoneum, thoracic cage, upper limbs and lower limbs fractures		
9	Male	62	4	Fall from height	Hemothorax, pulmonary laceration, renal and pancreatic lacerations, retroperitoneal hemorrhage, small vessel rupture, thoracic cage, upper limbs, lower limbs, pelvic and vertebral fractures	Hepatic laceration	
10	Female	26	4	Traffic accident	Hemothorax, pulmonary laceration, myocardial rupture, hemopericardium, small vessel rupture, thoracic cage, upper limbs and lower limbs fractures		
11	Female	62	1	Fall from height	Subarachnoid hematoma, hemothorax, retroperitoneal hemorrhage, small vessel rupture, facial, skull, thoracic cage, upper limbs and lower limbs fractures	Pulmonary laceration, hepatic, renal, and pancreatic lacerations	
12	Male	45	3	Traffic accident	Myocardial rupture, hemopericardium, thoracic cage, pelvic and lower limbs fractures		
13	Male	44	4	Traffic accident	Epidural hematoma, subdural hematoma, hemothorax, pulmonary laceration, hepatic, renal and pancreatic lacerations, retroperitoneal hemorrhage, small vessel rupture, thoracic cage, upper limbs, lower limbs, pelvic and vertebral fractures		
14	Male	31	1	Traffic accident	Epidural hematoma, subdural hematoma, hemothorax, pulmonary laceration, myocardial rupture, hemopericardium, small vessel rupture, thoracic cage, upper limbs and lower limbs fractures		Retroperitoneal hemorrhage