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Abbreviated injury scale-guided assessment of traumatic deaths: postmortem CT versus autopsy

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ABSTRACT

Objective: This study aimed to evaluate the diagnostic agreement between postmortem computed tomography (PMCT) and conventional autopsy in assessing injury severity and determining the cause of death using the Abbreviated Injury Scale (AIS).

Materials and methods: A retrospective analysis was conducted on 65 trauma-related fatalities that underwent both PMCT and autopsy. Injuries were classified by anatomical region and scored using AIS. Severity was categorized as minor (AIS 0–3) or major (AIS 4–6). The cause of death was determined based on either expert opinion or the highest AIS score per region. Agreement between PMCT and autopsy was analyzed using kappa statistics, correlation coefficients, and chi-square tests.

Results: Moderate agreement in AIS scoring was observed across most anatomical regions (36 %–52 %). Agreement improved substantially when classifying injuries as minor or major (78 %–86 %). The overall concordance for determining the cause of death was 33.85 % using expert opinion ($\kappa = 0.23$) and 55.38 % using AIS scoring ($\kappa = 0.41$). PMCT showed high sensitivity in detecting skeletal injuries but was limited in identifying soft tissue damage and vascular lesions, particularly in the abdomen and external surface regions.

Conclusion: PMCT demonstrates substantial agreement with autopsy in classifying injury severity, especially when guided by AIS scoring. While PMCT alone may not replace autopsy in all cases, its utility is enhanced through standardized injury scoring. PMCT may serve as a reliable adjunct or alternative in select forensic contexts, particularly where autopsy is declined or unavailable.

1. Introduction

Accurate determination of the cause of death is a cornerstone in forensic and medico-legal investigations, particularly in cases involving injury-related fatalities. Traditionally, standard autopsy has served as the gold standard for postmortem examination, offering detailed insights into anatomical abnormalities, trauma patterns, and underlying pathology [1]. However, autopsy is not without its disadvantages. It is an invasive and irreversible procedure, which can be emotionally challenging for families of the deceased, including cultural and religious objections [2]. Postmortem Computerized Tomography (PMCT) has emerged as a promising adjunct or alternative to traditional autopsy methods [3]. PMCT provides a non-invasive, three-dimensional visualization of internal structures, allowing for detailed assessment of skeletal injuries [4], gas embolism [5], and soft-tissue trauma [6]. Additionally, it circumvents several limitations associated with conventional autopsy, such as body dissection [7], and preserves the integrity of the deceased for cultural or legal purposes [8]. Despite its advantages, PMCT has limitations [9]. Studies have reported discrepancies between PMCT findings and standard autopsy results, highlighting cases where PMCT either overestimates or underestimates injuries [10]. This discordance underscores the need for a standardized and quantifiable approach to evaluating injury severity across both modalities.

The Abbreviated Injury Scale (AIS) is widely used in assessing the severity of injuries [11]. The AIS is an anatomically based scoring system that categorizes injuries into six body regions: head and neck, face, chest, abdomen, extremities and pelvic girdle, and external surface. Each injury is assigned a severity score ranging from 0 (no injury) to 6 (maximum severity, potentially untreatable) [12]. The AIS has demonstrated high reliability and consistency when used by trained

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professionals, making it a valuable tool for both injury classification and severity assessment [13]. Studies have shown that the AIS provides a standardized framework that reduces variability in injury scoring, allowing for reproducible and comparable results across different evaluators and diagnostic methods [14].

This study aims to directly compare PMCT and standard autopsy in identifying the cause of death in injury-related fatalities by utilizing AIS scoring to assess injury severity to verify the degree of alignment or consistency between PMCT and autopsy.

2. Material and methods

2.1. Study design and sample

This retrospective study included 65 cases of injury-related fatalities, all of which underwent both postmortem computerized tomography (PMCT) and conventional autopsy. For each case, detailed reports from both PMCT and autopsy were reviewed to evaluate injuries and determine the cause of death.

The autopsy reports were analyzed, and injuries were coded using the AIS by a forensic pathologist, while PMCT images were independently reviewed and coded using the AIS by a radiologist specialized in trauma and experienced in PMCT. The AIS scores obtained from PMCT and autopsy were subsequently compared to assess the level of agreement between the two methods (Fig. 1).

2.2. Inclusion and exclusion criteria

2.2.1. Inclusion criteria

- Injury-related fatalities that underwent both PMCT and conventional autopsy.
- Availability of complete PMCT and autopsy reports with comprehensive documentation of injury

2.2.2. Exclusion criteria

- Cases with incomplete or missing PMCT or autopsy reports.
- Cases presenting significant decomposition.
- Deaths resulting from complications secondary to traumatic injuries (e.g., infection, pulmonary embolism).

2.3. Data collection

Data collection involved the following components.

1. **Demographic Data**: Information on the sex and age of the deceased was recorded.
2. **Cause of Injury**: The cause of injury was determined based on data provided by police reports or other investigative records.
3. **Injury Scoring**: Injuries identified in PMCT and autopsy reports were coded using the Abbreviated Injury Scale (AIS). Each injury was categorized by anatomical region, such as head and neck, face, chest, abdomen, extremities and pelvic girdle, and external surface.

AIS scores were assigned to each body region, ranging from.

0 (no injury)
1 Superficial or mild injuries that do not require significant medical intervention.
2 Injuries that require medical attention but are not life-threatening.
3 Significant injuries that can impact function but are not immediately life-threatening
4 Life-threatening injuries that require immediate and advanced medical intervention
5 Life-threatening injuries with a very high risk of death or permanent disability
6 (maximum injury), Injuries that are not survivable given current medical capabilities

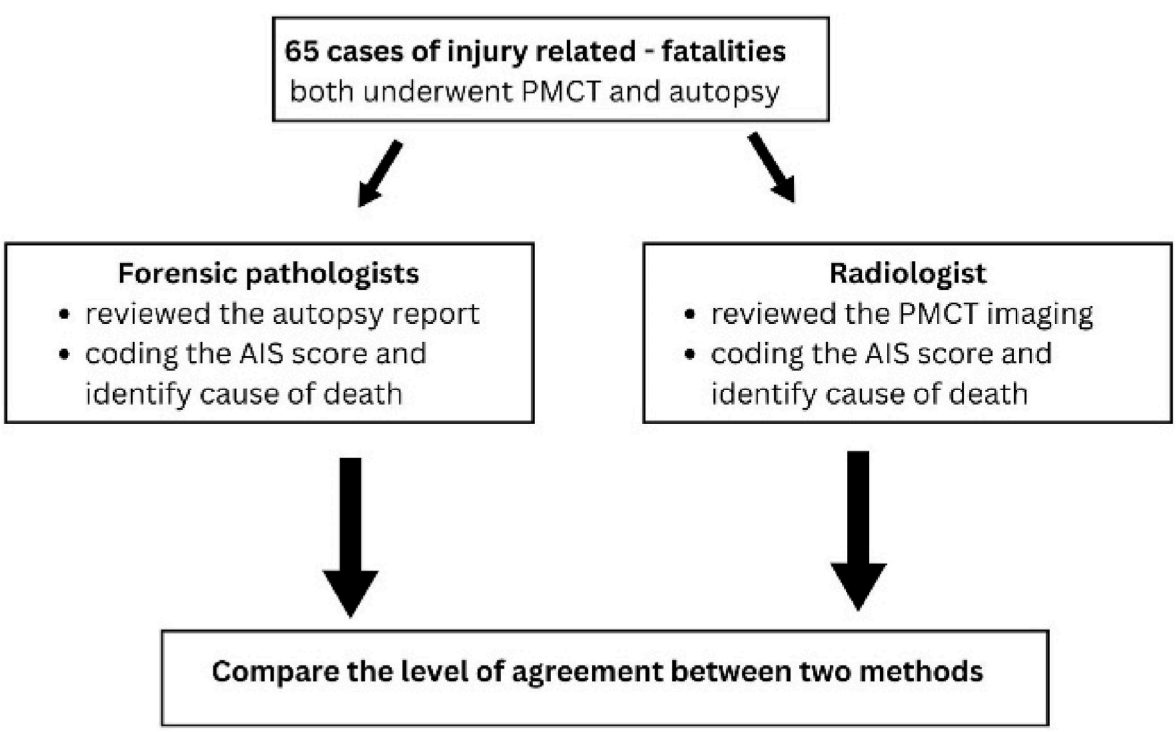

Fig. 1. Study design workflow outlining the comparison between postmortem computed tomography (PMCT) and autopsy in 65 injury-related fatality cases.

2.4. PMCT and autopsy techniques

2.4.1. PMCT technique

PMCT was conducted utilizing a 128-slice Aquilion CX scanner (Toshiba Medical Systems Corporation, Tokyo, Japan) or a GE Revolution HD scanner (GE Healthcare, Chicago, IL, USA). The scanning parameters were established as follows: slice thickness ranging from 2.0 to 2.5 mm, rotation time between 0.5 and 0.6 s, tube voltage set at 120–140 kVp, and tube current maintained at 200–300 mAs in the absence of intravenous contrast. The examination extended from the cranial region to the midpoint of the proximal thigh or further down, contingent upon the subject's height. Acquired images were subsequently organized for analysis within the Picture Archiving and Communication Systems (PACS), and the results of findings were documented in the reporting system. The images were evaluated by radiologists possessing expertise in postmortem imaging. The radiologists tasked with the interpretation of the images were informed only of the trauma history of the deceased.

2.4.2. Autopsy technique

Conventional autopsies were performed by a forensic pathologist, with assistance from residents training in forensic pathology. Systematic dissection of the head, chest, and abdomen was performed in all cases. Neck dissection was conducted selectively in cases where clinical or investigative findings indicated its necessity. The forensic pathologists conducting the autopsies were blinded to the PMCT findings at the time of examination.

2.5. Comparison of results between the two techniques

The findings obtained from postmortem computed tomography (PMCT) will be compared with those from the autopsy report, which has been coded using the Abbreviated Injury Scale (AIS) score. Injury assessments were compared using a region-specific, score-based matching protocol.

For the determination of the cause of death, matching will be established based on the selected anatomical region identified as the cause of death. In AIS-based analysis, the region with the highest AIS score was deemed the cause of death. In contrast, expert opinion referred to independent clinical judgment by a radiologist and a pathologist based on the case context. The matching will occur only if the identified region is the same in both techniques. If multiple regions have identical AIS scores, all such regions will be regarded as the cause of death, and a match will require concordance across all identified regions.

2.6. Statistical analysis

The agreement between PMCT and conventional autopsy findings was statistically analyzed using the following methods.

- Kappa Statistics (κ): The degree of agreement between PMCT and autopsy findings was measured using Cohen's kappa coefficient, with the following interpretive scale:
  - o 0.00: Poor agreement
  - o 0.00–0.20: Slight agreement
  - o 0.21–0.40: Fair agreement
  - o 0.41–0.60: Moderate agreement
  - o 0.61–0.80: Substantial agreement
  - o 0.81–1.00: Almost perfect agreement
- Correlation Analysis: The relationship between AIS scores assigned by PMCT and autopsy was evaluated using correlation coefficients.
- Chi-square Tests: Differences in diagnostic findings between the two methods were assessed for statistical significance.

Ethical approval

The study protocol was approved by the Human Research Ethics Committee of the Faculty of Medicine, Ramathibodi Hospital, Mahidol University (Approval Number: MURA2024/595).

3. Result

3.1. Demographic Data

A total of 65 cases were included in this study. The demographic characteristics of the studied cases are summarized in Table 1. These include age, sex, cause of death, and injury severity.

3.2. Comparison of AIS scores between PMCT and autopsy

To evaluate the agreement between postmortem computed tomography (PMCT) and conventional autopsy in injury assessment, the AIS scores from both techniques were compared across different anatomical regions. Fig. 2 illustrates the distribution of AIS scores for each region, highlighting the level of concordance between the two modalities. Larger circles indicate a higher number of cases with the same AIS score pairing, demonstrating areas of strong agreement.

The agreement percentage and Cohen's kappa coefficient for the assessment of injuries across different body regions using postmortem computed tomography (PMCT) and an autopsy were presented in Table 2. The kappa statistic quantifies the level of agreement beyond chance, with corresponding p-values indicating statistical significance. Agreement levels are classified based on standard interpretation criteria.

3.3. Agreement in severity classification (minor vs. major injuries)

When Abbreviated Injury Scale (AIS) scores were categorized into minor (AIS 0–3) and major (AIS 4–6) injuries, the agreement between postmortem computed tomography (PMCT) and autopsy showed significant improvement across most body regions. The highest agreement was observed in extremity injuries (86.15 %) and facial injuries (84.62 %). The level of agreement ranged from slight to substantial, with kappa values indicating substantial agreement for head and neck injuries and moderate agreement for facial, chest, and abdominal injuries. However, the agreement for external surface injuries could not be assessed due to limited variability in AIS scoring (Table 3).

3.4. Correlation between AIS scores (PMCT vs. autopsy)

A correlation analysis was conducted to assess the strength of the relationship between AIS scores derived from postmortem computed tomography (PMCT) and those assigned during conventional autopsy across various anatomical regions. The results demonstrated strong to

Table 1
Demographic data of the included cases.

Demographic data		N	Percent
Sex	Male	54	83.08 %
	Female	11	16.92 %
Age (years)	Min	15	
	Max	81	
	Average	37.42	
Causes of injuries	Traffic injury	36	55.38 %
	Fall from height	18	27.69 %
	Penetrating injury	9	13.85 %
	Blunt trauma	1	1.54 %
	Train collision	1	1.54 %
Total		65	100 %

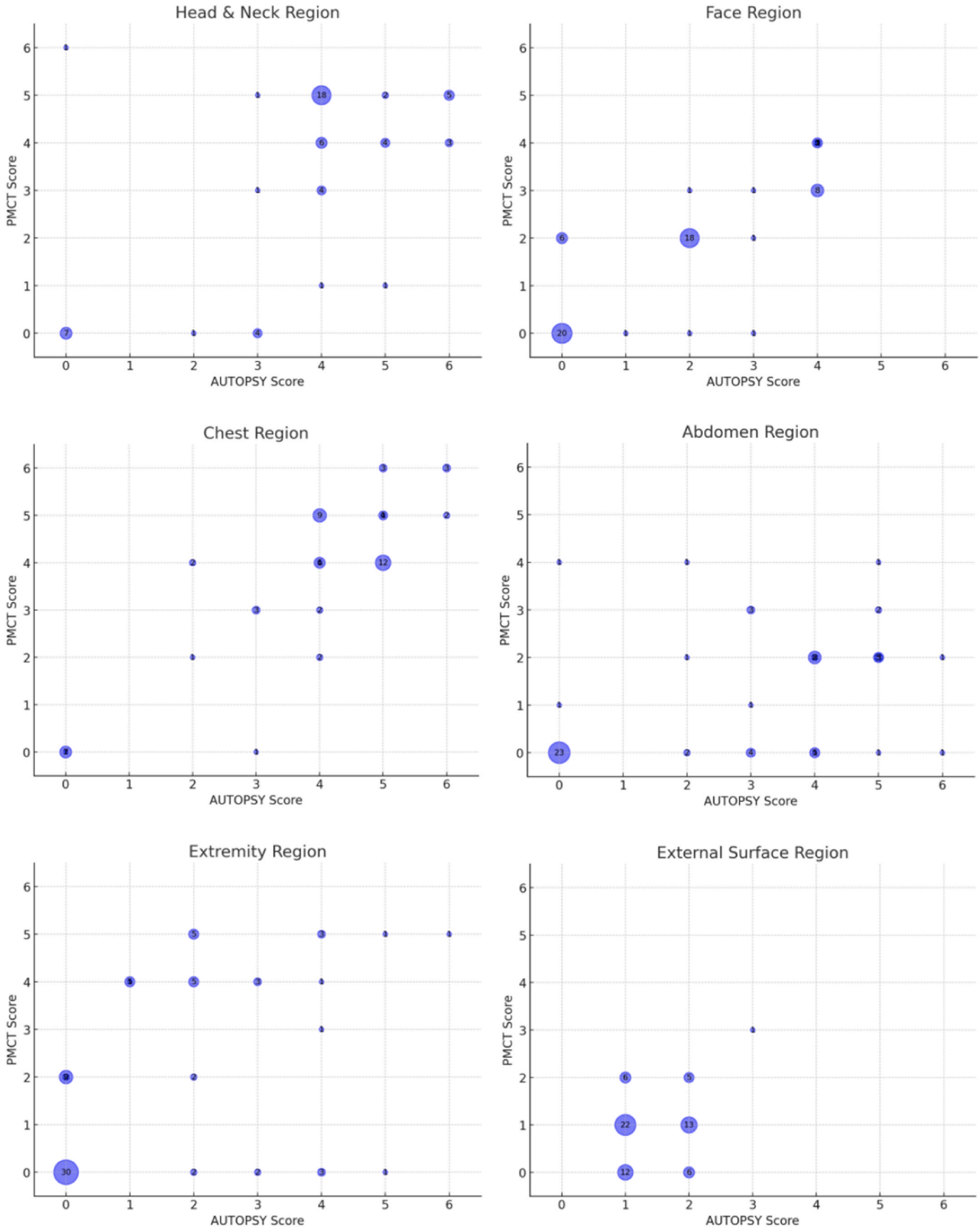

Fig. 2. Comparison of AIS scores between postmortem computed tomography (PMCT) and autopsy across different anatomical regions. Each scatter plot represents a specific region, with the x-axis indicating the AIS score from the autopsy and the y-axis representing the AIS score from PMCT. The size of each circle corresponds to the number of cases with the same score pairing, with larger circles indicating greater agreement between the two modalities.

Table 2
Agreement percentage and kappa analysis for the comparison between PMCT and autopsy.

Body region	Agreement percentage	Kappa	P -value	Level of agreement
Head and Neck Injuries	50.77 %.	0.3498	<0.001	Fair agreement
Facial Injuries	41.54 %	0.1558	0.0013	Slight agreement
Chest Injuries	36.92 %.	0.1966	0.0004	Slight agreement
Abdominal and Pelvic Injuries:	41.54 %.	0.1156	0.0413	Slight agreement
Extremities Injuries	52.31 %	0.2416	0.0003	Fair agreement
External Surface Injuries	43.08 %.	0.0605	0.2090	Poor agreement

Table 3
Agreement in Severity Classification (Minor vs. Major Injuries) Between PMCT and Autopsy.

Body region	Agreement percentage	Kappa	P -value	Level of agreement
Head and Neck Injuries	81.54 %	0.6041	<0.001	Substantial agreement
Facial Injuries	84.62 %	0.4348	<0.001	Moderate agreement
Chest Injuries	80.00 %	0.5769	<0.001	Moderate agreement
Abdominal and Pelvic Injuries:	78.46 %	0.4658	0.160	Moderate agreement
Extremities Injuries	86.15 %	0.0752	<0.001	Slight agreement
External Surface Injuries	NA	NA	NA	NA

Remarks: NA = not available.

very strong positive correlations in the head and neck region (r = 0.7583), chest (r = 0.6687), and extremities (r = 0.7783), indicating a high degree of alignment between the two methods in these regions. A moderate correlation was observed for facial injuries (r = 0.4041), while abdominal injuries showed a weak but statistically significant correlation (r = 0.2855). The correlation for external surface injuries was weak and not statistically significant, suggesting limited agreement in this region (Table 4).

3.5. Agreement in cause of death determination

The concordance between postmortem computed tomography (PMCT) and autopsy in determining the cause of death was assessed using two approaches: expert opinion and AIS-based analysis. When the cause of death was determined using expert opinions—specifically by identifying the anatomical region with the highest score—there was a 33.85 % reflecting only fair Kappa agreement. In contrast, when the AIS scoring system was used, agreement was higher at 55.38 %, with a moderate Kappa agreement (Table 5).

Table 4
Correlation coefficients between AIS scores from PMCT and autopsy across anatomical regions.

Body region	Correlation (r)	P -value
Head and Neck Injuries	0.7583	<0.001
Facial Injuries	0.4041	0.0008
Chest Injuries	0.6687	<0.001
Abdominal and Pelvic Injuries:	0.2855	0.0212
Extremities Injuries	0.7783	<0.001
External Surface Injuries	0.2087	0.0953

Table 5
Agreement between PMCT and autopsy in cause of death determination using AIS score and expert opinion.

Method of Cause of Death Determination	Agreement percentage	Kappa	P-value	Level of Agreement
Expert opinions	33.85	0.2296	<0.001	Fair agreement
AIS score	55.38	0.4085	<0.001	Moderate agreement

4. Discussion

4.1. Head and neck region

A moderate level of agreement was observed between PMCT and autopsy in evaluating head and neck injuries (κ = 0.3498, 50.77 % agreement). However, when injuries were classified as minor and major, the agreement improved significantly (κ = 0.6041, 81.54 % agreement), suggesting that both methods were more consistent in detecting severe injuries. The findings of this study indicate that PMCT and autopsy are equally effective in identifying severe injuries in the head and neck region that may contribute to the cause of death. However, PMCT offers superior detection of skeletal injuries [15], particularly fractures of the cervical spine, including small bony structures, as well as pneumocephalus (intracranial gas). This advantage is attributed to PMCT's ability to provide high-resolution, three-dimensional imaging, which allows for the identification of subtle or complex fractures that may be challenging to detect through conventional autopsy. Additionally, detecting intracranial gas during an autopsy is challenging, as the opening of the skull can lead to the release of intracranial gas, making it difficult to determine whether the gas was originally present before death. While pneumocephalus is not inherently fatal, it can contribute to serious neurological dysfunction and even death in cases of tension pneumocephalus (neurological "air tamponade"), where intracranial air pressure on the brain, leading to brainstem herniation [16]. In most cases of traumatic head injury, pneumocephalus is a secondary finding commonly associated with skull or basilar skull fractures. It is rarely the direct cause of death in traumatic head injuries [17].

Although PMCT and autopsy demonstrated only moderate agreement in detecting head and neck injuries, the areas where both methods aligned most frequently were the injuries that were severe and directly contributed to the death. This suggests that while PMCT and autopsy may differ in detecting certain lesions, they are both highly reliable in identifying fatal injuries that are critical in forensic investigations.

4.2. Facial region

The slight level (κ = 0.1558, 41.54 % agreement) of agreement suggests that PMCT and autopsy findings for facial injuries exhibit low concordance, which may be attributed to several factors. The main injuries of interest in the facial region are fractures of the facial bones, as they are the most significant and potentially life-threatening injuries in this area [18]. Other important injuries include vascular damage and eye trauma. In this study, PMCT detected facial injuries in 43 out of 65 cases, most of which were bone fractures. However, autopsy identified facial injuries in only 13 cases. This finding is consistent with previous research, which has shown that PMCT is highly effective in detecting skeletal injuries, particularly facial bone fractures [4]. One possible reason for this lower detection rate is the difficulty of fully examining the facial region during autopsy. The small and complex anatomy of the face makes it challenging to expose injuries, especially fractures that are not obvious externally. Additionally, full dissection of the facial structures is not routinely performed and is usually done only when there are clear signs of trauma, such as visible wounds or swelling. As a result, some fractures may go undetected if the face is not thoroughly examined during autopsy.

However, when injuries were grouped into minor and major categories, the agreement between PMCT and autopsy improved significantly (κ = 0.4348, 84.62 % agreement). This suggests that both methods are more reliable in detecting severe and life-threatening injuries, such as multiple maxillofacial fractures or large orbital fractures with displacement.

4.3. Chest injuries

The detection of traumatic chest injuries using postmortem computed tomography (PMCT) and autopsy revealed that PMCT detected 54 cases of chest injuries, while autopsy detected 52 cases. However, the overall severity agreement between PMCT and autopsy in assessing chest injuries was relatively low (κ = 0.1966, 36.92 %), indicating discrepancies between the two methods. When injuries were classified into minor (AIS 0–3) and major (AIS 4–6) categories, the agreement significantly improved (κ = 0.5769, 80.00 %), suggesting that both methods were more consistent in detecting severe injuries. The level of agreement between PMCT and autopsy in identifying fatal chest injuries is influenced by multiple factors, particularly the differences in detection capabilities between the two methods and the impact of postmortem changes on PMCT interpretation.

Previous studies [19] have demonstrated that PMCT has high sensitivity and specificity for detecting chest injuries, particularly air and fluid accumulations in the thoracic cavity and skeletal fractures, such as the thoracic spine, clavicle, and rib fractures. However, despite its effectiveness in detecting skeletal injuries, PMCT has limitations in assessing soft tissue injuries, which are often more accurately identified during autopsy [20]. Autopsy remains the gold standard for assessing soft tissue injuries, as it allows for direct visualization and tissue dissection and is particularly effective in identifying conditions such as lung contusions and vascular injuries, which may not be well visualized on PMCT [6]. A notable example highlighting this limitation is a case involving a 17-year-old male with traumatic chest injuries from a traffic accident. The cause of death in this case was determined to be subclavian artery and vein injury, which was identified through autopsy but was not detected on PMCT. This discrepancy was likely due to the fact that PMCT was performed without contrast enhancement, preventing the visualization of vascular injuries. The absence of contrast in standard PMCT scans remains a significant limitation when evaluating vascular trauma, as active hemorrhage and vessel disruption cannot be directly assessed without intravenous contrast administration. Another major factor influencing the agreement between PMCT and autopsy findings is the impact of postmortem changes on PMCT interpretation. The postmortem changes can complicate the differentiation between true antemortem injuries and artifacts that develop after death, potentially leading to misinterpretation of findings. Postmortem fluid shifts and lividity can result in the accumulation of pleural effusions or pooled blood, which may mimic hemothorax or pulmonary hemorrhage on PMCT, making it difficult to determine whether the observed fluid collections are truly the result of traumatic hemorrhage or merely postmortem redistribution [21]. Similarly, gas formation due to decomposition can be misinterpreted as traumatic pneumothorax or gas embolism, particularly in cases where PMCT is performed several hours or days after death. Furthermore, soft tissue decomposition can make the assessment of hemorrhages or contusions particularly challenging, especially in cases where the autopsy is delayed. However, this study excluded cases with advanced decomposition, minimizing the influence of decomposition-related artifacts on PMCT interpretation.

Although PMCT is a valuable tool for detecting thoracic injuries, it is important to recognize that it has limitations in identifying soft tissue injuries and hemorrhages, which are better assessed through autopsy. The combination of both PMCT and autopsy provides a more comprehensive evaluation of injuries, significantly enhancing the accuracy of forensic investigations, particularly in cases involving severe trauma from accidents, assaults, or other medico-legal circumstances.

4.4. Abdominal region

The agreement between PMCT and autopsy in detecting abdominal injuries is relatively low (41.54 %, κ = 0.1156). Previous studies [22] have demonstrated that PMCT has lower sensitivity and specificity for detecting abdominal injuries compared to autopsy. In particular, PMCT has poor sensitivity for detecting pancreatic injuries and only moderate sensitivity for hepatic injuries [23], which is consistent with the findings of this study. In this study, 12 cases in which PMCT failed to detect any abdominal injuries, whereas autopsy successfully identified them. Further analysis revealed that these undetected injuries primarily involved liver, spleen, and kidney lacerations, which significantly affected the determination of the cause of death. This discrepancy underscores the fact that PMCT alone is not sufficient to replace autopsy in the evaluation of abdominal injuries.

Fatal abdominal injuries play a crucial role in forensic and trauma investigations, as they frequently involve intra-abdominal organ damage, hemorrhage, or vascular injuries that can directly contribute to death. However, PMCT has several limitations in detecting fatal abdominal injuries, which impact its diagnostic reliability in forensic cases. One major limitation of PMCT is its poor sensitivity for detecting active hemorrhage. While PMCT can detect fluid collections in the abdominal cavity—such as ascites or hemoperitoneum—differentiating blood from other intraperitoneal fluids can be challenging. Although blood typically exhibits higher radiodensity than other fluids [24], the distinction is not always reliable on non-contrast imaging. Additionally, PMCT cannot evaluate soft tissue injuries and organ contusions. Unlike autopsy, which permits direct assessment of tissue discoloration and hemorrhage, PMCT relies solely on radiodensity differences, which may not reveal subtle or diffuse injuries. Consequently, organ damage without significant structural disruption may be overlooked in PMCT.

4.5. Extremities region

The agreement between PMCT and autopsy in detecting extremity injuries is 52.31 %, indicating a fair level of concordance between the two methods (κ = 0.2416). PMCT identified extremity injuries in 33 cases, whereas autopsy detected injuries in 23 cases. PMCT detected more fractures overall, particularly in the AIS 2 and AIS 3 categories. The injuries in these scores were predominantly minor fractures, such as radius and tibia fractures, indicating that PMCT is more effective in detecting minor traumatic fractures compared to autopsy.

However, when injuries were categorized based on severity into minor and major groups, the agreement between PMCT and autopsy increased significantly to 86.15 % (κ = 0.4658). This finding aligns with previous studies [6], which have highlighted that PMCT has distinct advantages in detecting bony injuries, particularly in cases of skeletal trauma, including long bone fractures (femur, tibia, humerus) and small fractures (metacarpals, metatarsals, and fibula). Subtle or non-displaced fractures, which are difficult to identify during autopsy, can be readily detected by PMCT's high-resolution imaging. Furthermore, PMCT provides 3D reconstructions, which are particularly beneficial for visualizing complex fractures or fractures concealed within soft tissue.

Given these advantages, PMCT appears to be more accurate than autopsy in detecting bony fractures and provides valuable additional information for injury reconstruction. Therefore, PMCT proves to be highly beneficial in the forensic assessment of extremity injuries, particularly in cases where skeletal trauma needs to be thoroughly evaluated.

4.6. External surface injury

The agreement between PMCT and autopsy in detecting external surface injuries is 43.08 %. The Kappa coefficient (κ) is 0.0605, suggesting a poor agreement between PMCT and autopsy findings for external surface injuries. The p-value (0.2090) indicates that the agreement is not statistically significant. The AIS for the external surface region is used to classify the severity of external injuries, including contusions, abrasions, lacerations, and burns. It provides a standardized approach to assessing trauma to the skin and soft tissues. The autopsy can identify external injuries in all 65 cases. However, the injuries were all minor (AIS 1–3), with no case being classified as major injuries (AIS 4–6). Consequently, no fatalities were attributed to injuries from this region. PMCT failed to detect external injuries in 18 out of 65 cases. The differences in their approaches can explain the discrepancy between the two methods. Autopsy involves direct visual inspection of the body, allowing for clear identification of external injuries.

In contrast, PMCT has limitations in detecting external soft tissue injuries, making it less effective for evaluating trauma in this region. This suggests that autopsy is more beneficial for identifying injuries on the external surface. Furthermore, examining external injuries does not require internal dissection, as these injuries are located on the outer body surface. Therefore, visual inspection during autopsy is both simpler and more practical than relying on PMCT for assessing external trauma.

4.7. Cause of death determination

Evaluating the concordance between postmortem computed tomography (PMCT) and traditional autopsy in determining the cause of death, utilizing expert opinion and the Abbreviated Injury Scale (AIS) as interpretive frameworks. The findings demonstrate that when expert opinion alone was used to interpret PMCT findings, the overall agreement with autopsy results was modest (33.53 %). In contrast, the application of AIS scoring improved the level of agreement to 55.38 %, indicating a substantial enhancement in diagnostic concordance.

Several factors may help explain the improvement in agreement. Although expert assessments are based on professional knowledge and experience, they are still subjective and can vary between individuals, especially when there is no standardized method to guide interpretation. In contrast, the Abbreviated Injury Scale (AIS) is a structured and anatomically based system that offers an objective way to score the severity of injuries across different body regions. Using AIS may reduce interpretive bias and facilitate a more reproducible evaluation of trauma-related mortality.

It is also important to acknowledge the inherent limitations of PMCT, particularly in the assessment of soft-tissue injuries, vascular lesions, and certain natural disease processes that may not be radiologically apparent. These limitations may partially explain the residual discordance observed, even when AIS is applied. Nonetheless, the incorporation of AIS into PMCT-based evaluations appears to enhance diagnostic accuracy. It may serve as a valuable adjunct in forensic investigations, particularly in contexts where conventional autopsy is unavailable or declined for cultural or religious reasons.

Taken together, these findings support the potential role of AIS as a standardized framework for injury assessment and cause of death determination in PMCT, and they underscore its value in advancing the objectivity and reliability of forensic radiological investigations.

4.8. Medicolegal implications

The findings of this study have practical implications for forensic policy and legal proceedings. The moderate agreement between PMCT and autopsy—particularly when guided by Abbreviated Injury Scale (AIS) scoring—supports its use as a structured, objective tool for injury documentation and cause-of-death determination. In medicolegal contexts where full autopsy may be declined for cultural or religious reasons, AIS-guided PMCT could serve as an acceptable alternative, particularly in cases of clear traumatic injury. Furthermore, the use of AIS enhances the reproducibility and transparency of radiological findings, potentially strengthening their admissibility as evidence in court. In mass casualty incidents or disaster victim identification (DVI), PMCT with standardized scoring allows for rapid triage and objective reporting, especially when autopsy capacity is limited. These findings support the integration of PMCT into national forensic guidelines, particularly when supported by radiologists trained in postmortem imaging and injury severity classification.

4.9. Limitation

The relatively small sample size, 65 cases, may limit the generalizability of the findings, as cases without complete imaging or autopsy data were excluded. Additionally, the exclusion of decomposed bodies and natural deaths further narrows the applicability of the results to a broader medicolegal population. Furthermore, although AIS provides a structured injury severity framework, the process of scoring injuries—especially in radiological interpretation—can be influenced by interobserver variability. Only one radiologist and one forensic pathologist were involved in injury coding, which may introduce bias or reduce reproducibility.

5. Conclusion

PMCT is highly effective in detecting skeletal injuries but has limitations in assessing soft tissue injuries, particularly in the abdomen and external surface regions. While PMCT and autopsy do not always detect the same injuries, both methods are highly reliable in identifying severe or life-threatening trauma. Combining PMCT with autopsy enhances injury detection accuracy and improves cause-of-death determination.

Additionally, the agreement in cause-of-death determination improves when using the AIS score, suggesting its potential as a standardized tool for injury assessment in PMCT applications. Integrating PMCT with autopsy provides a more comprehensive forensic evaluation, ensuring greater accuracy in trauma analysis.

CRediT authorship contribution statement

Kiratika Likkachai: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Visualization, Writing – original draft. **Sirote Wongwaisayawan:** Formal analysis, Investigation, Methodology, Supervision. **Kornpira Siriwes:** Data curation. **Wisarn Worasuwannarak:** Conceptualization, Investigation, Methodology, Project administration, Supervision, Validation, Writing – review & editing.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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