

Preclinical Medical Student Perspectives on Nonforensic Autopsy Presentations as Instruments for Understanding Basic Medical Sciences: A Small-Scale Study at an International College of Medicine in Thailand

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Background: Autopsies have played critical roles in understanding the pathological basis of diseases. Currently, non-forensic autopsy, which are also known as hospital autopsy, rates at several medical centers have declined. This trend could affect students' learning opportunities, particularly those at medical schools, where the number of autopsies has significantly decreased.

Objective: To evaluate the preclinical medical student perspectives on the autopsy presentation, together with the trend of non-forensic autopsies at Thammasat University Hospital.

Materials and Methods: The present study was divided into two parts. Firstly, the author performed a five-year retrospective review of the trend of non-forensic autopsies at Thammasat University Hospital. Secondly, an autopsy presentation was conducted as an interactive lecture session. Participants were third-year medical students enrolled in a medical sciences applications course. Autopsy cases were selected based upon the medical competency assessment criteria for the national license. The clinicopathological correlation was emphasized. At the end of the class, students were asked to complete an online questionnaire with a five-point Likert-type scale. Student satisfaction and suggestions about the autopsy presentation were analyzed.

Results: As in other medical centers, the rate of non-forensic autopsies at Thammasat University Hospital has been decreasing. The number of pediatric, particularly perinatal, autopsies dramatically outnumber that of adult autopsies. Most medical students agreed that autopsy presentation helps stimulate problem-based thinking (mean: 4.5 on the five-point Likert scale), learning clinicopathological correlations (4.4), improving understanding of pathophysiology (4.2), and refreshing knowledge of human anatomy (4.2).

Conclusion: Despite the declining trend in hospital autopsies, autopsy presentation is considered as a potential instrument for understanding clinical contexts by preclinical medical students whose clinical experience are limited. Careful preparation is needed to maximize the benefits of autopsy presentations.

Keywords: Non-forensic autopsy, Preclinical medical students, Clinicopathological correlation

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Autopsy, which is also known as a postmortem examination, is an examination of dead bodies for better insight into anatomy and investigation

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pathology. It has long been known that such investigation is essential for understanding the pathologic basis of diseases. Nevertheless, non-forensic autopsy, which is also known as hospital autopsy, rates at many academic medical centers have been declining for half a century⁽¹⁾.

Such a trend is a result of considerable reliance on current diagnostic techniques and problems acquiring autopsy consent from the grieving family⁽²⁾. A systematic review showed that the chance of a given autopsy would reveal relevant unsuspected diagnoses has subsided over time. Nevertheless, performing autopsy is still warranted to identify the cause of death⁽³⁾. The bereaved families have also resisted autopsies due to misinformation about the usefulness of the autopsy, concerns about postponements in funeral arrangements, and religious

Table 1. Summary of the selected hospital autopsy cases

Case	Age (years)	Sex	Clinical presentation	Previous medical history	Clinical diagnosis	Autopsy diagnosis
1	55	F	Watery diarrhea	HCC (S/P TACE) HCV cirrhosis	Diarrhea with septic shock	<ul style="list-style-type: none"> • Hepatocellular carcinoma • Cirrhosis • Esophageal varices • Portal hypertensive gastropathy • Cholestasis • Massive hepatic necrosis • Ascites • Congestive splenomegaly • Diffuse alveolar damage • Pleural effusion
2	52	M	Chest tightness and dyspnea	Dyslipidemia	Sudden cardiac arrest	<ul style="list-style-type: none"> • Atherosclerosis • Myocardial infarction (recent, old)
3	64	M	Fever and dyspnea	Advanced stage lung cancer	Pneumonia with septic shock	<ul style="list-style-type: none"> • Lung adenocarcinoma, multiple metastases • Bronchopneumonia • Diffuse alveolar damage
4	71	M	Fever and dyspnea	S/P kidney transplantation	Pneumonia with septic shock	<ul style="list-style-type: none"> • Invasive pulmonary aspergillosis • Cytomegalovirus pneumonitis • Diffuse alveolar damage • Acute tubular necrosis

F=female; M=male; HCC=hepatocellular carcinoma; S/P=status post; TACE=transarterial chemoembolization; HCV=hepatitis C virus

or cultural beliefs⁽⁴⁾. Regardless of the various reasons, this decreasing trend affects medical students' learning opportunities, particularly those at medical schools, where the number of autopsies significantly decreased.

However, data on non-forensic autopsy rates and medical student perception of autopsy presentation in Thailand is relatively limited. The present study aimed to evaluate the preclinical medical student perspectives on the autopsy presentation, together with the trend of non-forensic autopsies at Thammasat University Hospital.

Materials and Methods

Data on non-forensic autopsies at Thammasat University Hospital

A 5-year-retrospective review of data on non-forensic autopsies at the Division of Pathology, Thammasat University Hospital, was carried out. Cases of non-forensic autopsies were divided into pediatric (those under the age of 18) and adults (those at or over the age of 18). Data on the trend of such autopsies were analyzed.

Participating students

Thirty third-year medical students enrolling in the 'Application of Medical Sciences' course participated in this study. At the time of the teaching, they were preparing for the national licensing examination in

basic medical sciences, and they would be clinical medical students in a few months. Students were informed that their participation were voluntary and incurred no penalties if they did not participate. The present study was approved by the Human Ethics Committee of Thammasat University No. 1 (Faculty of Medicine), the number of COA was 112/2020.

Teaching methods

An interactive lecture session using hospital autopsy presentation as a tool for correlation of basic medical sciences and clinical sciences was conducted. Four selected non-forensic autopsy cases based on medical competency assessment criteria for the national license launched in 2012, were included. Homicidal or other violent deaths were beyond the scope of this session. During the session, the clinicopathological correlation was discussed and emphasized. Data on the selected hospital autopsy cases are summarized in Table 1. Examples of autopsy presentation (Case 1) are shown in Figure 1.

Online questionnaire

At the end of the class, students were asked to complete a fully anonymous online questionnaire regarding their satisfaction and suggestion with the hospital autopsy presentation. Ten survey questions with a five-point Likert-style scale (Likert scale of 1 to 5 with 1=strongly disagree and 5=strongly

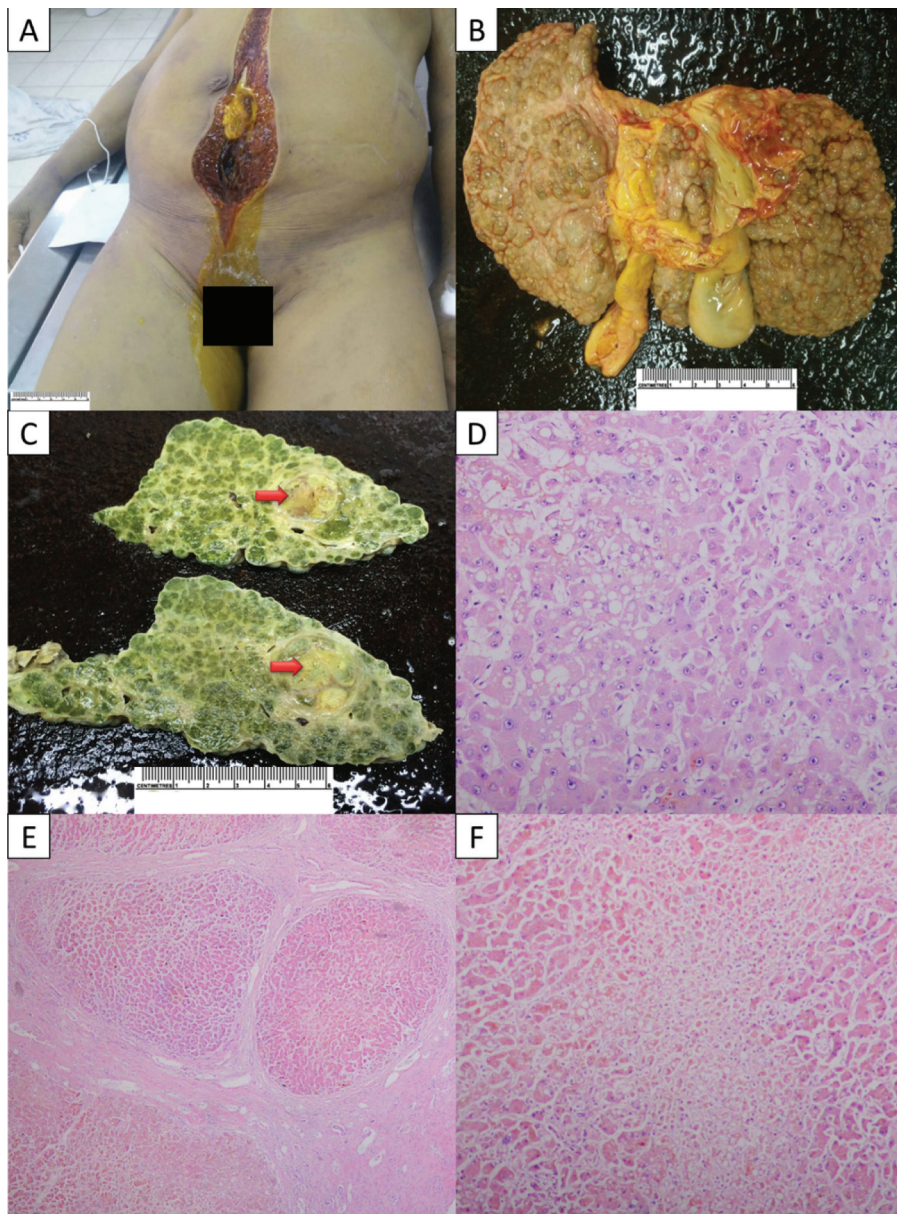


Figure 1. An adult patient with a known history of hepatocellular carcinoma (status post transarterial chemoembolization) with HCV cirrhosis (Case 1). It is a good opportunity for preclinical medical students to have a chance to study with a "whole body" of a deceased patient through an autopsy presentation before they see real patients in the upcoming clinical years. External examination revealed jaundice, a distended abdomen, and a large amount of ascitic fluid (A). The liver was cirrhotic (B). A 2.5-cm yellow/green nodule (red arrows) was observed on the cut surface (C). Histologically, this nodule is hepatocellular carcinoma, composed of cancer cells arranged in trabecular and pseudoglandular patterns with focal bile pigment (D, 400x). The background liver consisted of regenerative nodules separated by fibrous septa (E, 40x). Massive hepatic necrosis, which was the main cause of death, was detected (F, 100x).

agree) were used. Besides, there were open-ended questions in which students could provide additional feedback regarding the autopsy session. Students who did not complete the survey questions were excluded.

Statistical analysis

The data from the students' satisfaction scores were summarized using descriptive statistics with means and standard deviation. Statistical analysis was conducted using the software Microsoft Excel

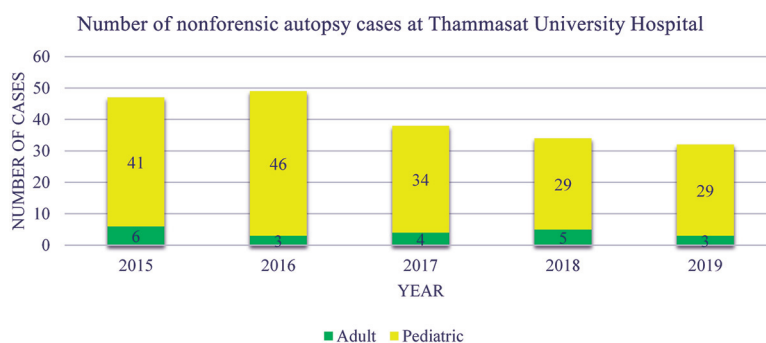


Figure 2. Number of nonforensic autopsy cases at Division of Pathology, Thammasat University Hospital. Note the overall declining trend of the number of nonforensic autopsy cases over time.

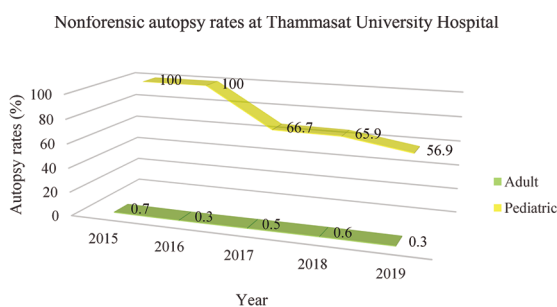


Figure 3. Nonforensic autopsy rates at Division of Pathology, Thammasat University Hospital. The pediatric autopsy rates are greatly outnumbered than that of the adult.

for Windows 10 (Microsoft Corporation, Redmond, Washington, USA). Data were presented as means \pm standard deviation (SD).

Results

Data on the trend of non-forensic autopsies at the Division of Pathology, Thammasat University Hospital, is illustrated in Figure 2 and 3. The number of non-forensic autopsy cases decreased from 49 cases in 2015 to 32 cases in 2019. This 5-year retrospective review also revealed that the number of pediatric, particularly fetal or perinatal, autopsies, which were 29 to 46 cases per year (about 90% of the total of non-forensic autopsies), greatly outnumbered the adult autopsies, which was two to six cases per year (about 10% of the total of non-forensic autopsies). The pediatric autopsy rates had declined from 100% in 2015 to 56.9% in 2019. Like the pediatric autopsy, the adult autopsy rates decreased from 0.7% in 2015 to 0.3% in 2019.

Sixteen students answered the survey questions. The response rate was 53.3%. The result of their ratings is shown in Table 2. Most of them preferred autopsy presentation and agreed that such learning

Table 2. Students' preference of nonforensic autopsy presentation with a five-point Likert-style scale

Survey questions	Mean \pm SD
1. Autopsy is a useful tool in pathology education.	4.1 \pm 0.9
2. Autopsy presentation should be included and has more role in the pathology course.	3.6 \pm 0.7
3. Autopsy helps me to recognize the real pathological changes in the human organs.	3.9 \pm 1
4. Autopsy helps me to recapitulate and refine my knowledge of human anatomy.	4.2 \pm 0.6
5. Autopsy can improve my understanding of pathophysiology.	4.2 \pm 0.8
6. Autopsy presentation can teach me about clinicopathological correlations.	4.4 \pm 0.7
7. Autopsy presentation is helpful for the understanding of medical errors.	4 \pm 1.1
8. Autopsy presentation can stimulate problem-based thinking.	4.5 \pm 0.7
9. I want to observe the postmortem examination.	2.5 \pm 1.6
10. I want to assist in dissecting organs during the autopsy.	2.3 \pm 1.6

SD=standard deviation

and teaching methods helped stimulate problem-based thinking (mean: 4.5 on the five-point Likert-scale), learning clinicopathological correlations (4.4), improving understanding of pathophysiology (4.2), and refreshing knowledge of human anatomy (4.2). Furthermore, autopsy presentation was also viewed as a useful tool in pathology education (4.1) and an understanding of medical errors (4.0). This probably resulted from seeing actual morphology and pathological changes in the human organs (3.9). Some students also provided further comments, including integrating autopsy presentation into problem-based learning and more time to discuss each case. On the contrary, most students did not want to observe the postmortem examination (2.5) or assist in dissecting organs during the autopsy (2.3).

Some students also suggested that hospital autopsies should be integrated into problem-based learning sessions. They would have more time to discuss and think of the pathologic basis of diseases. Details of each case might be given earlier so that students could go through each case before the beginning of the class. Autopsy presentation reflected using of pathology knowledge in the clinical context. Few students were bored with autopsy presentation since it might not be present in the upcoming national license examination, which focuses on basic medical sciences.

Discussion

A steady worldwide decline of autopsies over the last decades has been reported by many studies⁽⁵⁻¹⁰⁾. Notably, declining autopsy rates have been observed in both fetal or perinatal and adult autopsies⁽⁵⁻⁷⁾. Postmortem examination was performed in no more than 10% of deaths in the U.S.⁽¹⁾. In some countries, hospital autopsy was considered an exceedingly rare medical procedure, in which the practice might be on the verge of extinction^(6,7). A nationwide retrospective study revealed that autopsies rates were highest in academic medical centers, and such rates were also higher in younger patients⁽⁸⁾. Like other academic hospitals, the rate of non-forensic autopsy at Thammasat University Hospital has decreased for years. A 5-year retrospective analysis of non-forensic autopsies at Thammasat University Hospital showed that more than 85% of the hospital autopsies were that of pediatric, particularly fetal or perinatal autopsies. Surprisingly, the number of adult autopsies at the author's institution has been meager, ranging from two to six cases per year since 2015. Due to the scarcity of non-forensic adult autopsies and the tight schedule of the medical curriculum, preclinical medical students may not have the opportunity to observe postmortem examination of patients whose deaths were primarily caused by diseases. Of note, decreased autopsy rates mean fewer opportunities to experience procedures and results.

The reasons for the decline in autopsy rates are multifactorial and complicated. According to a survey, most US-based hospital administrators agreed that the advancement of diagnostics leads to a decline in autopsy performance⁽¹¹⁾. A systematic review also concluded that the chance of a given autopsy would reveal relevant unsuspected diagnoses has diminished over time⁽³⁾. Nevertheless, several studies reported that significant disagreements between clinical (antemortem) and autopsy (postmortem)

diagnoses were not uncommon even in the era of high-tech medicine⁽¹²⁻¹⁵⁾. The incidence of significant discrepancies, ranging from 7% to 23.5%, was highly variable among these studies⁽¹²⁻¹⁵⁾. The first three most frequently observed significant discrepancies were myocardial infarction, pulmonary embolism, and pneumonia^(12,13). Such discrepancies were similar to that noted Case 2, which was included in the autopsy presentation, in which the patient developed sudden cardiac arrest and passed away. While uncertainty arose in the clinical diagnosis of sudden death, the postmortem examination revealed acute myocardial infarction. Although there was no religious prohibition for autopsy and tissue retention, cultural, secular, or personal objections could lead to the objection of an autopsy by bereaved families⁽¹⁶⁾. Delayed funerals and cultural beliefs were also essential variables for the vanishing of non-forensic autopsies. Some refuse autopsy because they do not want their relatives' bodies to be disfigured due to postmortem examination⁽¹⁶⁾.

Despite the diminishing trend in non-forensic autopsies, clinical, educational, and epidemiological values of such medical procedures exist⁽¹⁶⁾. Post-mortem examination has been recognized as a part of improving medical knowledge and clinical practice. Not only bereaved families but also present and future patients would benefit from autopsies. Autopsy presentation has been considered as a potential tool for understanding clinical contexts for preclinical medical students whose clinical experience was limited. As the name implies, students may gain better insights into common diseases by observing postmortem examination, particularly in terms of appreciating the actual morphologic changes and a better understanding of pathophysiology⁽¹⁶⁾.

The result of the present study is similar to that of the previously published literature. Several studies regarding the application of autopsy for undergraduate, particularly medical students, teaching have been conducted⁽¹⁷⁻²²⁾. Most medical students agreed that an autopsy is a useful tool in the medical curriculum. It allowed them to recognize the "actual" morphology with pathological changes of human organs, understand clinicopathological correlations, know the fallibility of medicine, and improve their critical thinking skills^(17,19). Students also preferred some teaching modalities, such as virtual microscopy, autopsy presentation, and seminars⁽¹⁸⁾. One study concluded that students' autopsy-based teaching was highly valued and could be applied to many medical specialties⁽²⁰⁾. However, most participants did not want

to observe the postmortem examination and assist in dissecting organs during the autopsy. Another survey, in which participants were second-year medical students, also reported that most students agreed that medical students should assist in dissecting organs during an autopsy. However, only one-third stated that they should witness more autopsies⁽¹⁷⁾.

There were some potential drawbacks to the present study, since this was the first experience of using a hospital autopsy presentation for teaching medical students at the author's university, there was no comparison group such as a group without autopsy presentation. However, students' feedback regarding their understanding of autopsy presentation with clinical context and their satisfaction while attending the interactive lecture session using autopsy presentation as a teaching-learning modality was positive. Another limitation was that the number of participants was relatively low. Nevertheless, this represents a class of medical students at the author's institution.

The benefits of autopsy for undergraduate medical education should not be overemphasized. There are several disadvantages of autopsy in the setting of medical education⁽¹⁵⁾. Students could view a dead body as an object^(23,24). Moreover, students might not choose pathology as a career and not request autopsies after graduation due to unpleasant experience in autopsy seen during undergraduate program⁽²³⁾. Pathology resident trainees also indicated a discomfort level associated with their first autopsy regarding the odors or body fluids, the fear of making a mistake, and the uncertainty about what to do⁽²⁵⁾. As a result of these potential disadvantages, careful preparation is needed to maximize potential educational benefits.

The autopsy could become a powerful educational tool for healthcare professionals on several occasions, particularly, if meticulously prepared. Videos are an acceptable teaching tool for students, especially in centers where the autopsy rate is low⁽²⁶⁾. A team-based approach to autopsy education to develop a more holistic approach to pathology was also proposed⁽²⁷⁾. In Thailand, data of preclinical medical students' perspectives on the non-forensic autopsy is minimal. The present study suggested that the autopsy presentation has roles in pathology education and should be integrated into the preclinical medical student curriculum with an appropriate context. This is so, because postmortem examination can help preclinical medical students to understand the pathophysiology and clinicopathologic correlation of

common diseases. It may be useful to let preclinical medical students observe virtual autopsy before seeing real patients in the clinical years.

Conclusion

Despite the declining trend in hospital autopsies, autopsy presentation is a potential instrument for understanding clinical contexts by preclinical medical students whose clinical experience is limited. Of note, careful preparation is needed to maximize the benefits of autopsy presentations.

What is already known on this topic?

A steady worldwide decline of autopsies over the last decades has been reported. Autopsy presentation was viewed as a useful tool in the medical curriculum. However, data on non-forensic autopsy rates and medical student perception of autopsy presentation in Thailand is relatively limited.

What this study adds?

Like other academic hospitals, the rate of non-forensic autopsy at Thammasat University Hospital has been decreasing for years. Preclinical medical students agreed that autopsy presentation helps stimulate problem-based thinking, learning clinicopathological correlations, improving understanding of pathophysiology, and refreshing human anatomy knowledge.

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Conflicts of interest

The author declares no conflict of interest.

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