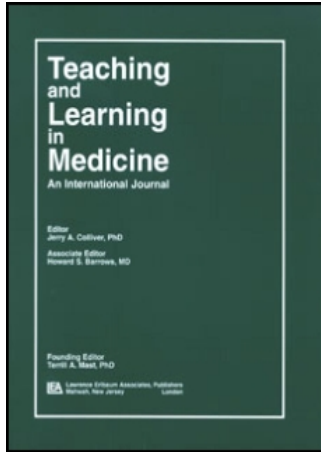


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### Should Forensic Autopsies Be a Source for Medical Education? A Preliminary Study

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# Should Forensic Autopsies Be a Source for Medical Education? A Preliminary Study

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**Background:** Practical anatomy sessions including dissection of cadavers are essential for anatomy courses. There are many difficulties in obtaining cadavers. In addition, hardened and discolored cadavers that are fixed with formaldehyde look unrealistic and generate apathy among students. **Purpose:** We considered that forensic autopsies may be used as ancillary and supportive practice in anatomy education. **Methods:** We invited the participation of Year 2 medical students in suitable forensic autopsy cases during the course of one year. Specialists of forensic medicine and anatomy provided theoretical support through talks in their specialized fields during the autopsy. At the end of the semester, feedback questionnaire forms were prepared and the students were asked to evaluate these sessions. **Results:** Forty students participated in the evaluation by completing the questionnaire. Students made positive statements about adequacy of the time of the application, consistency of the structures with theoretical and practical issues shown in anatomy lectures, and necessary explanations of the lecturers during and after the application. **Conclusion:** We think that forensic autopsies are an attractive supplementary educational model, and we have decided to continue the forensic autopsy practices. We believe that further studies on the evaluation of the sessions using a larger student population will lead to more conclusive results.

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Anatomy has been an essential component of medical education for centuries. Gross anatomy is based on didactic lectures, cadaver dissection, plastic models, and multimedia illustration in medical schools. Anatomic practices including

dissection of cadavers are an important and necessary part of anatomy courses. The number of cadavers dissected by each student is an important criterion of the quality of anatomy education.<sup>1</sup> However, there are some difficulties in practices with cadavers. One of these difficulties is insufficiency in obtaining cadavers. It is known that medical schools throughout the world have to cope with increasing numbers of students and a limited supply of cadavers for anatomy. Because of cultural and religious traditions in a predominantly Muslim country like Turkey, both donation and use of the cadavers in the anatomy courses are difficult.<sup>2–4</sup> The obtained cadavers, with limited availability, are fixed with formaldehyde, phenol, and alcohol and utilized for as long a time as possible. However, the cadavers fixed using formaldehyde and phenol tend to be hardened and discolored, so they look unrealistic and lead to apathy among students.<sup>1</sup> In addition, these solvents have various undesired toxic properties.<sup>5–8</sup> Specifically, formaldehyde has adverse effects like irritation, allergy, toxicity, mutagenesis, and carcinogenesis.<sup>5–8</sup> Previous studies from our laboratory have demonstrated that formaldehyde inhalation may cause damage and increase heat shock protein 70 (Hsp70) synthesis in the spermatogenic cells of testes,<sup>5</sup> in the pyramidal cells of the hippocampus<sup>8</sup> in rats. Formaldehyde also may cause cellular damage in the prefrontal cortex<sup>9</sup> and alter zinc, copper, and iron levels in the cerebral cortex<sup>6</sup> and testes.<sup>7</sup> In a few medical schools that do not have difficulty obtaining cadavers, fresh cadavers are used for dissection in anatomy courses. Essentially, color and texture are most realistic when using fresh tissue dissection.<sup>1</sup>

In this study, we hypothesized that forensic autopsies may be convenient as an ancillary method for anatomy practical lessons. For this purpose, we have aimed to evaluate the opinions of Year 2 medical students who participated in forensic autopsies regarding the use of forensic case autopsies as an ancillary to cadavers.

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This study was presented in the 4th Asian-Pacific International Congress of Anatomists as an oral presentation held in Kusadasi, Turkey, on September 7–10, 2005.

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## MATERIALS AND METHODS

In conformity with a protocol agreed upon between the anatomy and forensic medicine departments, the participation of 5 volunteer Year 2 medical students (5 students, from class list, had been included for each autopsy) was made available in each suitable forensic autopsy case (40 students in total) throughout one year. Specialists in forensic medicine and anatomy provided theoretical support through talks in their specialized fields during the autopsy. The dissections were slowed down to allow the students to observe anatomical structures. In addition, at the end of the autopsy, the students were allowed to review their observations for half an hour before the cadavers were closed. At the end of the semester, feedback questionnaire forms, with 4-point Likert-type scale, were given to the students for evaluation of these practical lessons.

According to the Likert scale, scores of 1, 2, 3, and 4 were assigned to *students absolutely do not agree with the idea*, *students do not agree with the idea*, *students agree with the idea*, and *students absolutely agree with the idea*, respectively.

## RESULTS

Forty students were included in the questionnaire. Sixty-five percent of participants ( $n = 26$ ) were male, and 35% were female ( $n = 14$ ). The mean age was  $19.50 \pm 0.94$ . Twelve students participated twice in the autopsy practical sessions (30%), and 28 students participated only once (70%).

The results of the questionnaire are shown in Table 1 as percentage and mean  $\pm$  standard deviation. According to the results, on a 4-point scale, students made positive statements about adequacy of the time of the sessions ( $3.00 \pm 0.65$ ), consistency of the structures shown in the sessions with theoretical and practical lectures ( $3.60 \pm 0.66$  and  $3.25 \pm 0.64$ , respectively), adequate explanations from the lecturers during and after the sessions ( $3.15 \pm 0.75$ ), and an interest to recall and necessity to repeat the practices in the coming years ( $3.70 \pm 0.66$ ). The students were of the opinion that these autopsy-based dissections should be repeated in either Year 3 (30%), 4 (20%), 5 (15%), or 6 (35%) of their medical school education.

TABLE 1  
Data of questionnaire results

No.	Parameters	Scale (%)				M $\pm$ SD
		1	2	3	4	
1	The duration of the practical lessons is adequate.	0	20	60	20	$3.00 \pm 0.65$
2	The structures which are shown in the autopsy practices were consistent with the theoretical anatomy lectures.	0	5	30	65	$3.60 \pm 0.66$
3	Autopsy materials are of high quality and available in entirety.	0	10	55	35	$3.25 \pm 0.64$
4	The structures which were shown in the autopsy practices were consistent with plastic anatomic models and cadavers in the practical anatomy lectures.	25	5	45	25	$2.70 \pm 1.23$
5	The specialists, who instructed the students, have adequate knowledge and skills.	0	0	0	100	$4.00 \pm 0.00$
6	The specialists gave the necessary explanations before and during the application.	0	20	45	35	$3.15 \pm 0.75$
7	The structures that were shown can be recalled for a long time.	0	0	65	35	$3.35 \pm 0.49$
8	It is recommended to repeat and recall these autopsy sessions in further years.	0	10	10	80	$3.70 \pm 0.66$
9	Dissection of the brain, particularly the cranial cavity and its inclusions were easy to observe and understand.	0	10	40	50	$3.40 \pm 0.68$
10	Dissection of the thorax particularly the thoracic cavity and its inclusions were easy to observe and understand.	0	0	55	45	$3.45 \pm 0.51$
11	Dissection of the abdomen particularly the abdominal cavity and its inclusions were easy to observe and understand.	0	0	45	55	$3.55 \pm 0.51$

Notes: Data are presented as percentage and mean  $\pm$  standard deviation of the 4-point Likert scale. According to the Likert scale; the scores are 1 (*students absolutely do not agree with the idea*), 2 (*students do not agree with the idea*), 3 (*students agree with the idea*), and 4 (*students absolutely agree with the idea*).

## DISCUSSION

Owing to a dearth of fresh cadavers for anatomy practical sessions for medical students, we initially hypothesized that forensic autopsy cases could be used as fresh cadavers for dissection lessons in anatomy. To achieve this we recruited volunteer students (in groups of 5) to participate in forensic autopsy sessions, along with relevant lecture schedules, and then asked for the opinion of the students in the form of a questionnaire. Interestingly, we obtained very positive feedback from the students who participated in this study.

In Turkey, the major source of cadavers is unclaimed bodies from mental and state hospitals. In addition, with a new revision in Turkish laws, in cases in which a legal autopsy was performed and the body was not claimed by relatives within 15 days, the body is given to anatomy departments to be kept there for at least 6 months. If the body is not claimed within this period, the body is used as a dissection cadaver for the anatomy education of students.

Lately, many medical schools have been facing shortages of cadavers for the anatomy dissection lessons. One likely reason is an increase in the number of medical schools and medical students since the 1980s. The other is a decrease in the number of unclaimed bodies and few cadaver donations.<sup>4,10</sup> The primary reason for the decline in cadaver donations appears to be the donors' reluctance to be cut into pieces after death. In addition, religious beliefs and cultural traditions also impede people from donating cadavers, a problem that appears to be difficult to overcome. To corroborate this issue, Sehirli et al. reported that none of the anatomists in Turkey have decided to donate their bodies for dissection. A total of 15.7% of them are ambivalent about their decision, while the remaining 63.9% of the respondents were firm in their conviction not to donate their body.<sup>4</sup> This fact is discouraging and emphasizes the difficulty in obtaining cadavers.

In this century, didactic lectures and traditional anatomy practices including dissections of cadavers have been enriched by a multiple range of special study modules, problem-based workshops, computers, plastic models, and other teaching tools.<sup>11</sup> In addition, Robinson et al. suggested that the use of fresh tissue dissection of the thorax and abdomen of the rat is a valuable tool for teaching human anatomy.<sup>1</sup> We think that the major reason for the emergence of alternative methods used in human anatomy education might be the inability to obtain cadavers.

The universities are independent institutions devoted to education and research. Therefore each medical school can determine its educational curriculum and methods of instruction, resulting in the use of a wide variety of instructing methods and tools. However, it is commonly accepted that real cadavers are an essential part of the medical education, and the student-cadaver encounters, followed by student-patient encounters, are of paramount importance in medical education. In addition, cadaver dissection is essential not only for undergraduate medical students but also for postgraduate students such as research

assistants and specialists in surgical sciences.<sup>11,12</sup> The aim of our preliminary study was to find ancillary ways to acquire cadavers and make them available for the education of students. We believe that forensic autopsy cases have potential as an additional method for anatomy education where there is difficulty in acquiring cadavers.

We observed many advantages in the fresh forensic autopsies compare with formalin fixed cadavers throughout the study, some of which are as follows:

1. Formalin fixed cadavers harden and discolor, so they are unrealistic, resulting in a lack of interest from the students. However, fresh cadavers have real human color and softness. Hence, students can recognize tissues and organ systems better during these practical sessions, the knowledge of which will be essential in their future careers. This hypothesis was supported by the high percentage of students who agreed with Item 2 ("The structures that are shown in the autopsy practices were consistent with the theoretical anatomy lectures") and the 30% who disagreed with Item 4 ("The structures that were shown in the autopsy practices were consistent with plastic anatomic models and cadavers in the practical anatomy lectures"). We suggest that anatomical structures should be from a freshly dissected human body, a gold standard as is indicated in students' answers. Although anatomy lectures are accurate in describing the human body, plastic models and cadaver dissection are viewed by many students as inadequately representing true human anatomy.
2. According to Turkish law, cranial, thoracic, and abdominal cavities are opened in the classical autopsies. This allows the students to see the nervous, cardiovascular, respiratory, digestive, and urogenital systems in near-real states.
3. Because several forensic autopsies are carried out at any one time, a larger proportion of students get the opportunity to work with fresh cadavers.
4. In some parts of Turkey, female cadavers are difficult to acquire, hence students do not dissect the female urogenital system and cannot obtain the necessary information from models. However, female cadavers are occasionally available for forensic autopsies, which would allow students to familiarize themselves with female urogenital system.
5. Because the students who participate this program are in the presence of observers during these sessions, it should not cause any legal, criminal evidence, or ethical problems.

However, there are some negative aspects of forensic case autopsies:

1. There are some biological hazards in using fresh materials, such as infectious diseases (AIDS, hepatitis B virus, hepatitis C virus, meningococemia, etc). The students who participated in these sessions were in the presence of observers and did not touch the cadavers without protective garments (gloves, laboratory coats, overshoes, and bouffant

caps). Although these protective garments may make the learning process more difficult for anatomy students, the garments did eliminate the biological risks

2. Forensic case autopsies are usually executed rapidly, occasionally at a speed that hinders students from gaining meaningful information from what they are seeing. However, anatomical dissection is a long process that allows the student to become engaged with the human body as a whole over a period of weeks; thus, students attending a single session of autopsies need to be evaluated on a totally different scale. In our city, forensic autopsies are performed at the frequency of two or three per week. The dissections were significantly slowed down to allow the students to observe some of the structures. In addition, at the end of the autopsy, the students were allowed to revise their observations for approximately half an hour before the cadavers were closed. Because the students observed the autopsies as an ancillary method of study, it was felt that they were not shown all the organ systems, but they knew they would see and learn the organs and structures in their anatomy lectures.
3. Generally, the autopsy process is shallower and coarser than anatomical dissection. Therefore, some structures such as duramater, internal thoracic artery, and phrenic nerve can be damaged and thus overlooked by the students. During the trial sessions for this study, the instructors tried to show these structures to students when necessary.
4. Three cavities including cranial, thoracic, and abdominal cavities are opened in classical forensic autopsies, so it is usually not possible to learn the anatomy of the locomotor system.
5. In some forensic cadavers, the body may have been entirely destroyed in the event of road traffic accidents, burns, or suicide as the cause of death. In this study, we eliminated the autopsies in which the bodies were potentially disintegrated. In addition, students participated in autopsies carried out within the first 24 hours following the death, to eliminate the possibility of using a cadaver that was putrefied.
6. A forensic scientist may occasionally disfavor the presence of students, seeing them as a distraction, particularly in cases of a sensitive nature where there is a need for careful gathering of evidence. In this study, students were not included when autopsies were believed to be complicated.

Being a comparatively small medical school, we were able to ensure the participation of only 40 students in this pilot experiment. In addition, the number of autopsies carried out in our region is relatively few (two or three per week). These autopsies

are done outside of the university, and the number of faculty members attending these autopsies is also limited. However, we can envisage this working in a large medical school with as many as 250 students participating each year. In addition, the students were not uniformly consistent in their attendance of the autopsy sessions, resulting in a disjointed and unpredictable course. However, this study was designed as a preliminary experiment, and based on the positive response from the students, we believe that in the future more students can be taken to legal autopsies.

In conclusion, although we support the idea that cadaver dissection should be continued in anatomy practical lessons, we propose that in the event of a dearth of fresh cadavers, forensic autopsy materials are an attractive supplementary educational model, in spite of the disadvantages enumerated above. Consequently, based on the results of our questionnaire, we have decided to continue the practice of using forensic autopsies to educate medical students.

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