

REVIEW ARTICLE

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Medicolegal autopsy administration

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Abstract

The term autopsy which means “seeing with one’s own eyes” origins from the words “auto” and “opsis”. There are two types of autopsy as medical and forensic autopsies. In all suspicious or traumatic death, in which the etiology cannot be explained, autopsy should be performed. Before performing the autopsy information about the incident and any medical documents should be evaluated and essential preparations should be made. Autopsy should begin with the external examination and followed by the internal examination, cranial, thoracic and abdominal spaces should be evaluated. Special findings such as presence of froth in bodies that are pulled out of water should be recorded. Although it can vary depending on the case, toxicological, histopathological and biological sampling should be conducted in all cases. Preparing and using external examination forms for special cases such as firearm injuries, needle stick and sharp object injuries, cases that are pulled out of water and hanging cases, would help to develop standardized methods.

Keywords: Medicolegal autopsy, autopsy procedure, autopsy forms

The word “autopsy” origins from the unification of the words “auto” and “opsis” and has a meaning as “seeing with one’s own eyes” (1–4). The word “autopsy” is widely used throughout the world and there is no ambiguity about its meaning. A synonymous word “necropsy” means the dissection and the examination of the corpse but is less frequently used (2,5). The term “post-mortem examination” is widely used in the United Kingdom, but this term does not provide any information about the content of the examination or whether any dissection is performed after the external examination (5,6).

Although medical regulations and law systems vary across the world, there are 2 basic types of autopsies as legal and medical autopsies.

Medical autopsy: is the kind of autopsy that is performed to reveal pathological etiologies, to examine the relationship between the clinical incidents and anamnesis, to determine the variations and the causes of the variations (environmental effects, diseases...), to evaluate the accuracy, convenience, validity of the diagnosis and the treatment, to investigate unknown contagious and genetically diseases and for educational and scientific purposes. Written informed consent from the family members of the deceased, is essential for performing the medical autopsy (7,8).

Legal autopsy: is performed to detect the cause of death, identify the predisposing factors, determine the time of death and the injuries resulting in death, clarify the formation of injuries and non-legal diseases and provide expert reports for the court (1,5,9,10).

The main objectives of the legal autopsy are as the following:

- Defining whether the remnants belong to a human or an animal,
- Determining the identity, the size and the physique of the corpse,
- Determining the time of death,
- Determining the cause of death,
- Identifying the mechanisms (conditions and form) of death (detection of the findings that help to determine the origin),
- Detection of proofs of injury due to assault, suicide or accident,
- Defining the proofs that reveal the time between the injury and death,
- Defining the order of injuries,
- Identifying the movements after injury and detecting the duration and the distance of movements,
- Determining the injuries (external and internal), describing and sizing the injuries,
- Determining whether fatal injuries occurred at the scene where the corpse is found,
- In case of more than one assaulter, identifying which of the suspects committed the injury,
- Detecting whether the newborn was born alive or showed any capacity to survive,

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- Determining the fatal disease (evaluating the external and the internal abnormalities and malformations).
- Preserving organ and tissue samples for providing further proof (sampling for toxicological, microbiological, histological examinations and etc.)
- Collecting photo and documents which could be as a proof.
- Delivering the body to his/her family as undamaged as possible.
- Documenting the findings in full complement and providing expert view using these findings (1,5,9,11–15).

Autopsy should be performed in the following;

In all traumatic and suspicious deaths in which no certain cause of death could be determined, autopsy should be performed. These include;

- Murder or suspicion of murder
- Child abuse
- Intoxication
- Asphyxiation due to drowning or hanging
- Sudden deaths including sudden infant death syndrome
- Suspicion of human rights violation such as torture or maltreatment
- Suicide
- Malpractice suspect
- Transportational, occupational or domestic accidents
- Occupational diseases
- Natural-technological disasters
- Corpses with no id or corpses found in skeletal form
- Deaths in dormitories or hotels
- Deaths in prison, detention cell or during military activities (1,4,16–18).

The Autopsy Procedure

Before performing the autopsy, information about the incident should be gained from the legal departments, family members of the deceased and the pre-death treatment documents should be evaluated if possible (1,4). In case of child abuse, and for determining the number and location of the foreign bodies, X-ray should be performed. Autopsy should begin after completing the preparations and pre-autopsy information collection (11,19).

External Examination

1. If the body is clothed, the corpse should be photographed and taken into video in clothes, then clothes should be taken off and their relationship with the wounds and the detail of clothing should be noted.
2. After taking off all the clothing, the body is photographed and taken into video as completely naked.
3. Identification of the corpse is performed by the Prosecutor's Office by showing the corpse to the witness.
4. In the identification the following should be determined: Age, gender, skin color, weight, height, body structure, hair and eye (both the color of the iris and the sclera, the status of the pupils, the sclera and the conjunctiva), congenital and acquired deformities, tattoos and previous medical intervention findings.
5. Postmortem changes: rigor mortis, livor mortis (distribution, shape, color, intensity), the temperature of the body (rectal, sub hepatic temperature), putrefaction findings are recorded.
6. Environmental changes are noted (e.g. animal bite,

environmental temperature, the environmental state of the incident scene).

7. In suspicion of any legal incident, sampling for DNA isolation from underneath the nails, the genital and anal regions is performed.
8. Any recent traumatic lesions, their anatomical localization and characteristics (size, width, depth, and margin characteristics) are recorded.
9. Detailed examinations of the mouth, the oral cavity, armpits and genital area are performed since lesions in these areas are easily omissible.
10. Blood drawn from the femoral vein, aqueous humor and urine drawn from the suprapubic region are sampled in accordance with the varying laboratory conditions.
11. External examination forms for some characteristic cases are shown below (1,4,5,20–23).

Internal Examination

For the internal examination, all the organs which are excised from their anatomical regions should be weighed and their surface characteristics should be described. Weight of samples, sent for histopathological and toxicological examination should also be noted.

Examining The Skull

1. A circumferential cut connecting the two auricles is made, starting just above the mastoid process.
2. Soft tissues between the scalp and the skull are dissected by bistoury in a blunt fashion.
3. Scalp is peeled off from the forehead to the occiput.
4. Scalp is peeled off till the eyebrow line and peeled back over the face.
5. Temporal muscles on both sides are dissected downwards starting from the upper insertion point of the muscle.
6. A complete and circumferential saw cut is made, starting about 2 cm above the orbita and the auricle on both sides. A supportive triangular structure is formed via this section, with the occipital bone being the base of the triangle and the merging point of the lambdoid and the sagittal sutures as being the apex of the triangle.
7. Calvarium is removed by the raspatorium.
8. Dura is examined and superior sagittal sinus is inserted. Dura mater is cut in a parallel fashion to the incision line.
9. CSF sampling from the lateral ventricles can be performed at this stage.
10. Tentorium is made accessible by cutting the olfactory bulbi, optic chiasm, cranial nerves and vessels. By inserting the bistoury into the petrous part of the temporal bones, tentorium's are excised. The remaining cranial nerves and vessels are cut and passed down through the foramen magnum and the spinal cord is transected as far down as possible. Thus the brain, the cerebellum, the brain stem and the upper segments of the spinal cord are excised.
11. The surface characteristics of the brain, the cerebellum, the brain stem and the upper segments of the spinal cord are recorded.
12. Arteries forming the Willis polygon are examined in detail.
13. The cross-sections of the brain are as the following:
 - The 1st Cross-Section: is made through the temporal lobe
 - The 2nd Cross-Section: is made through the optic chiasm
 - The 3rd Cross-Section: is made through the mammillary

bodies

- The 4th Cross-Section: is made through the anterior part of the pons
 - The 5th Cross-Section: is made through the posterior part of the pons
14. Dissection per 1 cm is performed on the brain stem.
 15. After examining the dural sinuses and the hypophysis gland, dura is stripped out and the cranium is examined (1,4,5,20,24).

Examining The Thorax

1. Regarding the first four ribs, the chest wall along the midclavicular line is punctured via the needle of the syringe and pneumothorax test is performed by removing the piston and filling the syringe with water.
2. An incision starting from the submental region and ending in the pubic region is made, leaving the umbilicus on the right side of the incision line.
3. Pectoral muscles are flayed off to both sides. A dissection allowing the inspection of the ribs and the sternum is made by stripping off all the soft tissues over the chest wall.
4. Careful examinations including the inspection and the palpation of the chest wall, the sternum and the ribs are performed.
5. Height of the diaphragm is measured.
6. By using either electrical saw or knife, ribs are dissected from the bone-cartilage joint, with caution not to damage the thoracic organs.
7. Intercostal muscles and diaphragm are cut with a knife and the sternum is released.
8. After removing the sternal valve, the thoracic cage, the thoracic cavity, the skin and the subcutaneous tissues are examined.
9. Heart is removed. Presence of any fluid is evaluated via pulling the precordium upwards with a forceps and making a upside down Y shaped cut. In the presence of any fluid, the amount and the characteristics of the fluid are recorded.
10. Organs inside the mediastinum are examined including the inspection and the palpation and blood is drawn from the heart if necessary.
11. Main vessels ascending from the heart are excised with transection being as far from the heart as possible. Heart is weighed. The external appearance and vascular structures are examined. The right atria is incised by tracking the blood flow and the vena cava. After opening the right atria, the right ventricular wall is cut across the apex. Right ventricle wall is cut closely to the apex and pulmonary arteries are opened. Pulmonary veins are cut across and left atrial appendix is opened. Left ventricle wall is cut till the apex. Transection is widened from right under the mitral valve to the ascending aorta. Ostia of the coronary arteries are examined. Left circumflex, left anterior descendant and right coronary arteries are examined by performing transections. The septum and the anterior wall of the left ventricle are transected. Atria's, ventricles, valves, papillary muscles, corda tendinous and the septum are examined and weighed.
12. Lungs are removed out of the thoracic space. Hilar structures are cut and lungs are removed. Lungs are weighed and taken to the dissection board. Main bronchi, lobar bronchi, pulmonary arteries and veins are cut open. By placing the knife on the bifurcation notch of the main bronchi, a lateral cut is made. Intrapulmonary vessels and bronchi over the surface of the

cross-section are opened. 1 cm thick slice cross-sections are taken. Samples are collected from each lobe for toxicological and histopathological examinations (1,4,5,20,24).

Removal of the Neck Organs

1. A dissection starting from the frenulum is performed, teeth and the oral cavity are examined. Afterwards dissections of the skin and the subcutaneous tissue are performed starting right below the chin and ending on the jugular incisura. After performing careful examination of the neck muscles, a graded dissection is performed.
2. During the graded dissection, the sternocleidomastoid muscle as well as the other neck muscles, is pulled from the nearby tissues with a forceps at one end and dissected with a bistoury, with caution to preserve its structure.
3. Through the submental region the floor of the mouth is incised by bistoury, the lower pharynx is removed, the tongue is freed and taken out by hand.
4. Neck organs are freed by dissecting the vertebral column from the nearest spot to the end.
5. Esophagus is fastened at its inferior end.
6. Esophagus is opened using scissors and its lumen is examined.
7. Larynx and trachea are cut upside down with scissors and examined internally.
8. Careful examinations of the hyoid bone and the thyroid cartilage are crucial for the autopsy. These structures are especially important in case of any neck trauma. After freeing the tongue, tongue is sticking out using the left palma and tissues connecting the major horns of the hyoid bone and the upper horns of the thyroid cartilage are dissected with the bistoury on the right hand. By deepening the incision, nearby tissues are dissected and the hyoid bone is revealed. A careful examination containing inspection and palpation is performed.
9. Common carotid arteries, internal jugular veins are released and dissected (1,4,8,11,20,24).

Examination of the Abdomen

1. Abdomen is inspected with regards to abdominal organs being in their anatomical positions and examined for the presence of any fluid or blood.
2. By moving the bowels to both sides, retroperitoneal region and organs are examined.
3. Duodenum is opened and its mucosa is cleaned and by palpating the hepatoduodenal ligament, biliary flow to the duodenum is examined.
4. Falciforme ligament and other ligaments which connect the liver to the diaphragm are cut.
5. Liver is removed by cutting the hepatic arteries, hepatic veins, the portal vein and the choledoch duct.
6. Liver is weighed and placed over the dissection board. Macroscopic surface findings are recorded. Liver is dissected in 1-2 cm slices.
7. Spleen is pulled out and the hilus is cut, thus the spleen is freed and removed. A deep incision through the axis is made and parenchymal characteristics are evaluated.
8. The two strings that are tied at the duodenal level and stomach is removed by cutting at the half of the strings. Stomach is opened with an incision to integrate both sphincters on the minor curvature. Stomach content, its characteristics, structure, viscosity and liquidity are recorded. Sampling of the content is performed for the toxicological examination.

9. Pancreas is dissected and removed from the surrounding tissue.
 10. Kidneys along with the adrenals are removed from the retroperitoneal region together by a straight blunt dissection.
 11. Small intestines are removed from their meso and taken out.
 12. Insertion points of the large intestines are cut one by one, starting from the caecum. Sigmoid colon is tied using 2 strings and cut right in the middle and freed.
 13. Pelvic organs such as uterus, both ovaries, fallopian tubes and 1/3 upper part of the vagina are removed all together as a complex, in female cases.
 14. Spermatic cord is found under the inguinal ligament and testicles are taken out with care in male cases. Prostate gland is dissected.
 15. Suprapubic urine sampling from the bladder is performed for the toxicological examination (1,4,5,11,20,24).
- After the completion of the autopsy, the body should be reconstructed and organs should be sutured back to their places. After completely closing and cleaning the body, the corpse is handed to the family members with an "inhumation and transportation license" which is conducted by the Prosecutor's Office.

Evaluation of the Firearm Injuries

External Examination Findings

(Should be filled separately for every single wound.)

Wound No:

Scopy Examination (The body localization, number of the metallic bodies and their characteristics):

Clothes:

Photography : Distance Shot: ☐ Close Shot: ☐

The localization of the wound, its distance to the main anatomical structures, to the apex of the head and to the midline:

Characteristics of the wound: (Size, shape)

Carbon black: Yes ☐ No ☐ Burnt: Yes ☐ No ☐ Gunpowder remnants: Yes ☐ No ☐

Barret mark: Yes ☐ No ☐ Tattoos around the entrance wound: Yes ☐ No ☐

Characteristics and the qualities of the medical interventions which are applied to the wound:

Evaluation of the Sharp/Sharp-Penetrating/Penetrating/Sharp-Crushing Object Injuries

External Examination Findings

(Should be filled separately for every single wound.)

Wound No:

Photography : Distance Shot: ☐ Close Shot: ☐

Quality of the wound: [] Cut [] Sharp-Penetrating Object Wound [] Sharp Object Wound
[] Sharp-Crushing Object Wound

The localization of the wound, its distance to the main anatomical structures, to the apex of the head and to the midline:

Characteristics of the wound: (angle, margin, depth, length, tail, route, its location as clockwise):

Characteristics and the qualities of the medical interventions which are applied to the wound:

Abrasions and ecchymosis related with the wound:

Evaluation of the bodies which are pulled out of the water**External Examination Findings**

Photography : Distance Shot: ☐ Close Shot: ☐

Maceration Findings (Especially on the hand and the feet skin):

Goose bumps (Cutis anserine):

White froth around the mouth and the nose (color, size and other characteristics):

Sand and water plant contamination:

Trauma findings:

Evaluation of the hanging cases**External Examination Findings**

Photography : Distance Shot: ☐ Close Shot: ☐

The characteristics of the rope or the hanging material (color, length, type of the knot, surface characteristic, width etc.):

Livor mortis (Especially on hands and feet's):

Ligature mark (its location with regards to the thyroid cartilage, its distance to both auricles, width, depth, color changes around the mark):

Petechial (Face, eyelid, conjunctiva, etc.):

Other traumatic findings:

Conclusion

Development of standardized application methods, are required for medical autopsies to serve in accordance with their goals. These standardized application protocols would help in making more accurate diagnosis as well as lessening the center-origin bias and the odds of false results. These developments would also be helpful for performing better supervision. Use of external examination finding forms would help to detect findings easier and provide better retrospective data categorization, especially in specialized cases. These forms are designed to be used in both medical and legal autopsies, detailed photography section is included and case-specific procedures, such as scopy examination in firearm injuries are defined. We believe that by using standardized forms that fit the national conditions, clearing personal and departmental bias and increasing the reliability of autopsies via developing better supervision, would be easier.

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