

Evaluation the postmortem diagnostic accuracy of needle necropsy in comparison with conventional autopsy in heart and lungs samples of the cadaver

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Abstract: Introduction: An autopsy includes a detailed external examination as well as dissection of organs from the different body cavities –cranial, thoracic, abdominal and pelvic. Needle necropsy is a method in which different tissue samples are taken from body after death without skin incision, opening the chest and abdomen or making any disfiguration in body. We tried to evaluate the reliability of needle necropsy and concordance between postmortem diagnostic accuracy of needle necropsy and conventional autopsy in cadavers. **Material and Methods:** In a cross sectional study, we studied the samples that were taken from different organs of 100 cadavers like heart and lungs with conventional open biopsy and needle necropsy in The Legal Medicine Organization of Kerman in Iran from 2009-2011. Statistical analysis was done using SPSS software version 16. **Results:** In Heart samples, the sensitivity and PPV of needle necropsy was 100% in Congestion, Acute MI, Autolysis and Carditis diagnosis, but the accuracy was 0% in diagnosis of CAD and Valvular Diseases. In 31 cases there were no heart diseases, in which PPV was 91.2% in needle necropsy. In lung samples there was high rate of sensitivity and concordance in diagnosis of the problems like pulmonary hypertension, autolysis, anthracosis and pulmonary edema in needle biopsy, but these rates were lower in ARDS diagnosis. In 11 cases there was no lung disease, in which PPV was 84.1%. **Conclusion:** On the basis of our findings, results of needle necropsy is reliable enough in the cases with generalized involvement of the organ, but it is not sufficient in the focal involvements which are located in limited anatomical positions; like coronary artery diseases and valvular heart diseases. This study showed that the sensitivity rate and concordance rate of needle necropsy and conventional open biopsy are similar to each other and are reliable for diagnosing.

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Introduction:

Twenty percent of all deaths are subjected to medico-legal autopsies. In many countries, including the UK, where relatives' consent is required, however, including the UK, clinical autopsy rates have been declining since the 1950s. In the UK, even in teaching hospitals, the clinical autopsy rate has fallen to only 10% of deaths or less. (1)

What is autopsy?

The term 'autopsy' literally means to 'see for oneself', and is synonymous with the terms 'postmortem', 'post-mortem examination' and 'necropsy'. An autopsy includes a detailed external examination as well as dissection of organs from the different body cavities –cranial, thoracic, abdominal

and pelvic. Examinations restricted to a particular body cavity or to sampling of the organs in the opened body with a biopsy needle are also regarded as autopsy examinations.

What is needle necropsy?

Needle necropsy is a method in which different tissue samples are taken from body after death without skin incision, opening the chest and abdomen or making any disfiguration in body.

Importance of conventional non-coronial hospital autopsy:

Traditional autopsy has changed little in the past century, consisting of external examination and evisceration, dissection of the major organs with

identification of macroscopic pathologies and injuries, and histopathology if needed (2).

Clinical autopsy is a professional activity that demands profound medical knowledge and extended technical skills. Furthermore, clinical autopsy is one of the most powerful educational tools for both medical students and pathology residency training programs (3).

The main objectives for conducting autopsies include the following:

1. Evaluation of the accuracy of clinical diagnosis.
2. Investigation and discovery of unsuspected diseases.
3. Study of the cause, natural history, and course of diseases.
4. Recognition of causes of death.
5. Assessing the validity of new diagnostic and therapeutic modalities.
6. Evaluation of the quality of medical care.
7. Educational as well as medical practice or physicians, while clarifying medico-legal issues surrounding death (4, 5).

The information obtained from autopsies not only instructs and confirms but also serves as a pathway of study and source of investigation. The goal of autopsy is not to point out to clinicians their mistakes or judge them but rather to inform clinicians so they learn from their own mistakes. Despite improvements in diagnostic technology, the frequency of misdiagnosis has not decreased significantly (6).

The impact of seeing the morbid anatomical features of disease is potent and long-lasting. The discovery of clinico-pathological discrepancies in the post-mortem room is also a powerful tool for identifying faults in medical practice and the need for clinical audit utilizing autopsy data.

The autopsy is an integral part of protocols for the verification of cause of death in clinical trials in which death, or its avoidance, is an outcome measure; deaths in clinical trials may be due to the intervention, to unrelated disease or to the condition which is the trial's focus of attention(1).

Alternatives to a full autopsy Limited autopsies

The full autopsy is unrivalled as a method of auditing the reliability of clinical diagnosis, because complete dissection of the body ensures that significant unexpected morphological findings are detected. In some cases, however, performing a full autopsy may not be feasible, but would be prepared to allow a less extensive examination. Thus a limited autopsy may be problem-oriented, focusing on an organ or body cavity in which there is the greatest clinical curiosity. An alternative form of limited autopsy is the use of endoscopic techniques that do not require the large incisions or removal of organs for which some relatives may withhold their agreement.

Needle autopsy, performed under lawful circumstances, also enables very fresh tissue to be obtained very soon after death irrespective of whether there is subsequently to be a full autopsy. Both the above forms of autopsy are not an alternative to a conventional full autopsy, but rather different forms of limited autopsy.

Non-invasive autopsies:

Many institutions across the world are evaluating imaging as a non-invasive means of performing an autopsy. This is due to the personal, religious or cultural objections to the autopsy by dissection and the stressful nature of seeking consent at a time of bereavement. Amongst the imaging techniques, magnetic resonance imaging (MRI) has thus far proven to be the most promising in the various studies being conducted (1).

Failure to reach ante mortem diagnosis is a common problem in medicine. Even with the exclusion of lack of facilities and diagnostic experience there are other un-avoidable factors that include:

- (a) Limited time prior to demise
- (b) Cardiovascular instability of the patient for invasive investigations or exploratory laparotomy
- (c) The presence of coagulopathy
- (d) Limitations of serological or radiological markers in diagnosis: hence, the need for autopsy that provides important information for both research and clinical practice (7, 8).

Since postmortem sampling of tissues from certain organs can provide 'meaningful pathological alterations' that aid in diagnosis of disease (9), we tried to evaluate the reliability of needle necropsy and concordance between postmortem diagnostic accuracy of needle necropsy and conventional autopsy in cadavers.

Material and Methods:

In a cross sectional study, we studied the samples that were taken from different organs of 100 cadavers (77 male and 23 female) like heart and lungs with conventional open biopsy and needle necropsy in The Legal Medicine Organization of Kerman in Iran from 2009-2011. Firstly, the samples were adopted with needle necropsy method, then conventional open biopsy was done and the samples were sent to pathology department to assay. It is needed to say that, these procedures were only done on the cadavers that autopsy assay was required.

All the samples were coded, fixed, processed in tissue processor, blocked and finally H&E staining was done.

After processing the samples, all the samples were assayed by a pathologist individually. For evaluating the diagnostic value of the needle necropsy, conventional autopsy was considered as gold standard method. Sensitivity rate and Positive

Predictive Value (PPV) were calculated for each diagnosis and statistical analysis was done using SPSS software version 16.

Results:

In a cross sectional study, we studied the samples that were adopted from different organs of

the 100 cadavers (77 male and 23 female). Mean age of the cadavers was $37/8 \pm 14/7$ years of old.

In Heart samples, the sensitivity and PPV of needle necropsy was 100% in Congestion, Acute MI, Autolysis and Carditis diagnosis, but the accuracy was 0% in diagnosis of CAD and Valvular Diseases. In 31 cases there were no heart diseases, in which PPV was 91.2% in needle necropsy (Table1).

Table 1. Comparison between postmortem diagnostic accuracy of needle necropsy and open autopsy in heart samples and sensitivity and PPV of needle necropsy.

Diagnosis	Type of sampling				True Positive	Sensitivity (%)	PPV (%)
	Open		Needle				
	N**	%	N	%			
Hypertrophy	35	35	48	49/5	33	94/3	68/6
Congestion	5	5	5	5/2	5	100	100
Acute MI	1	1	1	1	1	100	100
Old MI	6	6	5	5/2	5	83/3	100
Within normal Limits	33	33	34	35	31	93/9	91.2
Autolysis	3	3	3	3/1	3	100	100
Carditis	1	1	1	1	1	100	100
Coronary Artery Disease	11	11	0	0	0	0	-
Valvular heart disease	2	2	0	0	0	0	-
Hypertrophy + CAD	2	2	0	0	0	0	-
CAD+AMI	1	1	0	0	0	0	-
Total	100	100	97*	100	78	78	80/4

*Failure in adoption of 3 samples; **N= Number

In lung samples there was high rate of sensitivity and concordance in diagnosis of the problems like pulmonary hypertension, autolysis, anthracosis and pulmonary edema in needle biopsy, but these rates were lower in ARDS diagnosis. In 11 cases there was no lung disease, in which PPV was 84.1% (Table2).

Table 2. Comparison between postmortem diagnostic accuracy of needle necropsy and open autopsy in lung samples and sensitivity and PPV of needle necropsy.

Diagnosis	Type of sampling				True Positive	Sensitivity (%)	PPV (%)
	Open		Needle				
	N**	%	N	%			
Congestion	2	2	1	1/1	1	50	100
Within normal limits	11	11	13	14/5	11	100	84/1
Autolysis	2	2	2	2/2	2	100	100
Pulmonary Hypertension	1	1	1	1/1	1	100	100
Adult Respiratory Distress Syndrome	2	2	0	0	0	0	0
Pneumonia	2	2	1	1/1	1	50	100
Pulmonary edema	29	29	26	28/9	25	86/2	96/1
Acute Pulmonary edema	16	16	15	16/7	15	93/8	100
Anthracosis	10	10	10	11/1	9	90	90
Anthracosis + Emphysema	25	25	21	23/3	21	84	100
Total	100	100	90*	100	86	86	95/6

*Failure in adoption of 10 samples; **N= Number

Comparison between sensitivity rate of needle necropsy and conventional biopsy and concordance between Accuracy rates of them are shown in Figure 1 and 2.

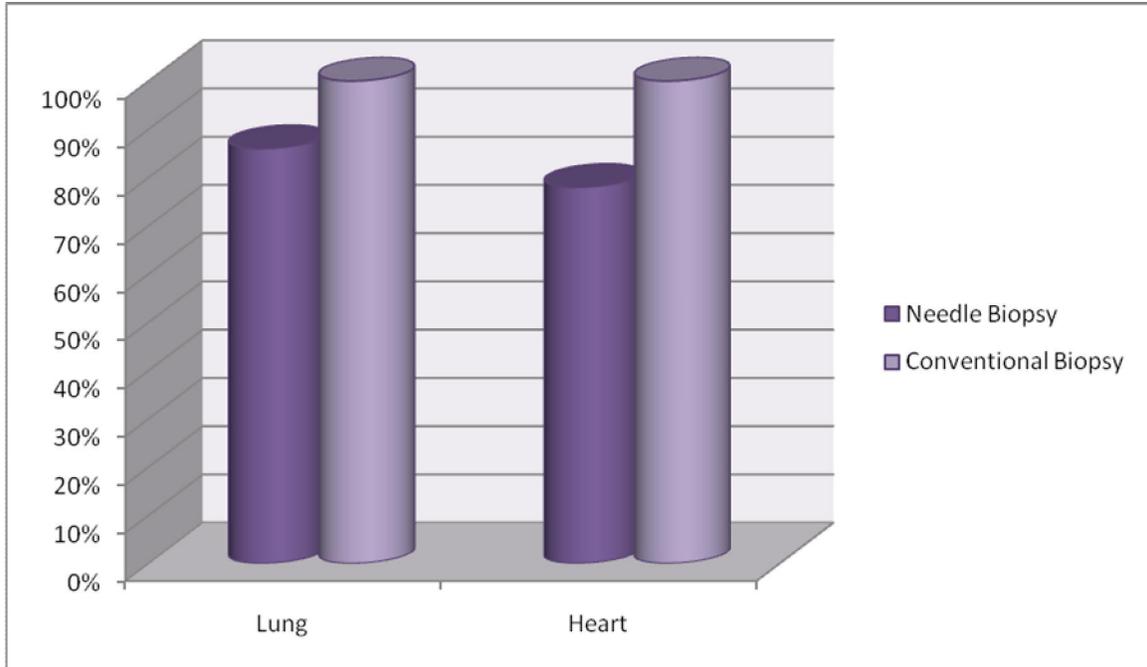


Figure 1. Comparison between sensitivity rates of needle necropsy and conventional biopsy.

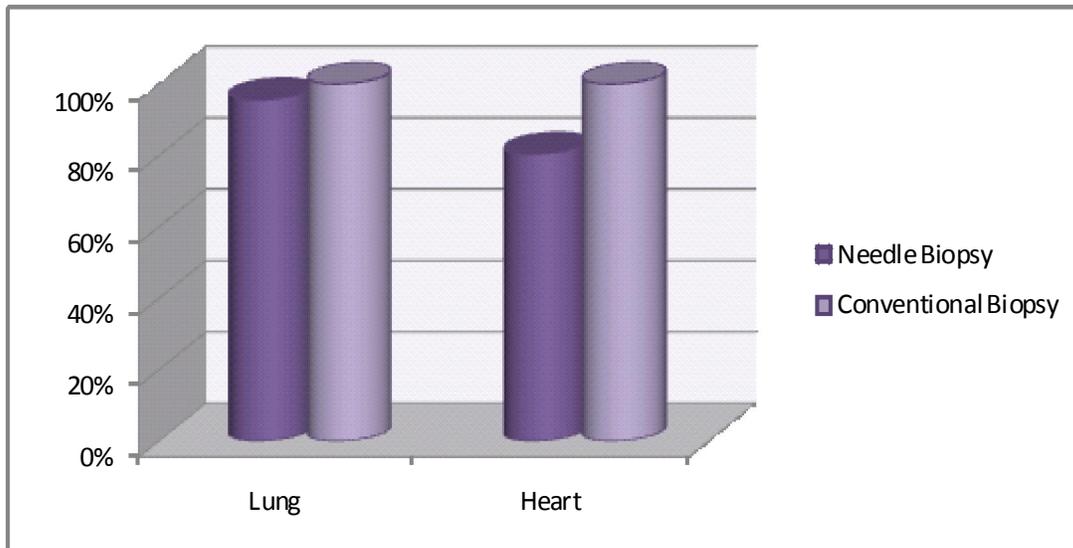


Figure 2. Concordance between Accuracy rate of needle necropsy and conventional biopsy

Discussion:

In this study, we studied the different samples of different organs such as heart and lungs of the cadavers referred to the dissection salon of the Legal Medicine Organization of Kerman, which were adopted by needle biopsy method and conventional biopsy. Considering the article review done by our researchers, There was no an exactly similar assay like our study. In our study, there was a failure in sample adoption with the rates of 3% and 10% in heart, and lung samples, respectively.

In Heart samples, the sensitivity and PPV of needle necropsy was 100% in Congestion, Acute MI, Autolysis and Carditis diagnosis, but the accuracy was 0% in diagnosis of CAD and Valvular Diseases.

In 31 cases there were no heart diseases, in which PPV was 91.2% in needle necropsy. Overall, sensitivity rate was 78% and concordance was 80.4% in heart samples in needle autopsy. In a study in America, they studied 20 cadavers with needle biopsy, which there was 100% concordance between

postmortem findings and pre-mortem clinical findings (10).

In lung samples there was high rate of sensitivity and concordance in diagnosis of the problems like pulmonary hypertension, autolysis, anthracosis and pulmonary edema in needle autopsy, but these rates were lower in ARDS diagnosis.

In 11 cases there was no lung disease, in which PPV was 84.1%. In a study by Huston BM et al, there was

90% concordance between needle biopsy findings and clinical findings, while this rate was 85% in open biopsy (10). In our study there was 95.6% concordance with clinical findings and 86% sensitivity in needle necropsy method.

On the basis of our findings, concordance rates in lung and heart samples were 95.6% and 80.4%. Maximum rate of sensitivity was seen in lung samples and heart samples were in next stages with sensitivity rate of 89%, 86% and 87%. In a study there was 87% concordance in both two methods with major pre - mortem findings.

In a study by Foroudi et al, they studied the cadavers which the cause of death was clear in 43% cases which gone under needle biopsy and 95% which gone under conventional biopsy. While the cause of death became clear with needle biopsy, in 8 of 9 cases (89%) there was complete concordance between findings of open autopsy and cause of death (11).

In another study in Kuwait, they found that needle autopsy is not suitable for small organs like parathyroid gland and focal abnormal findings in greater organs (7).

Conclusion:

Autopsy is always something unwanted, which is admired in some communities. Sometimes it is due to religious ideas and sometimes it is due some other personal views. In many countries having permission for doing autopsy is necessary and without permission from family of the dead person, it is illegal. In recent decade a progressive reduction is seen in most of the communities.

On the basis of our findings, results of needle necropsy is reliable enough in the cases with generalized involvement of the organ, but it is not sufficient in the focal involvements which are located in limited anatomical positions; like coronary artery diseases and valvular heart diseases.

This study showed that the sensitivity rate and concordance rate of needle necropsy and conventional open biopsy are similar to each other and are reliable for diagnosing. Needle biopsy is cost effective, easy method that can be done in some special situations like emergency situations. This

method has its own deficiencies because of limited amount of sample that can be solved with designing the appropriate needles with greater diameter and length. Needle biopsy can also be used in some other situations like infectious cases like cadavers with AIDS or B-Hepatitis to control the spread of the infection. Needle Necropsy can be used as a replacement for conventional open autopsy in any situation that open autopsy is not performable.

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