Original Research Paper

Gross and Histopathological Study of Adrenal Glands from Routine Medico legal Autopsies

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Abstract

Background: Autopsies are important in clinical medicine as they can identify medical errors and assist in continuous improvement. The role of a forensic pathologist is highly significant in determining the cause of death as an undiagnosed case can contribute to the improvement of clinical or surgical management of such type of patients, and help prevent unexpected deaths in the future. In an era, where pathological autopsies are limited, the medico-legal autopsy will serve as supplement to document the incidental adrenal pathologies in the study population.

Material and Methods: The prospectivestudy was performed after getting proper approval from Institute ethical committee. The adrenal glands were procured from medico-legal autopsies conducted from 2019 -2021, at the mortuary of Govt. Medical College and Hospital, Aurangabad. All the necessary details were noted from the police requisition, Inquest panchnama and clinical papers provided. All the important findings were noted down in the predesigned case record form.

Result: A total of 128 adrenal glands were examined for gross and histopathological changes. The number of males and females studied comprised of 38 males (59 %) and 26 females (41%**).** Majority of lesions were observed on histopathology as compared to gross examination. Maximum number of the lesions were observed in the age group between 21 to 30 years (29%). Gross adrenal lesions were noted in 62% males and 38% females. Histopathology lesions were noted in 63% males and 37% females. The study showed more of unnatural cases than natural cases. Majority of the lesions are seen in unnatural deaths than natural deaths except enlarged adrenals are found in natural deaths. Majority of the adrenal histopathology lesions were found in unnatural deaths except adrenalitis, hypertrophy and atrophy which is common in natural deaths. Majority of the lesions are found in unnatural deaths both on gross 73% as well as histopathological 67% examination.

Conclusion: This study emphasizes the importance of Gross as well as Histopathological examination in medicolegal autopsies. In cases of negative autopsies, this necessitates to examine the adrenal glands, histopathologically which may give a clue about the cause of death.

Key words: AdrenalGlands, Histopathological changes, Gross examination, Medicolegalautopsy, suprarenal gland.

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Introduction

A complete autopsy is necessary to substantiate the truth of the evidence of eyewitnesses. In forensic pathology, partial autopsy has no place. [1] An autopsy is performed by opening all the three body cavities where every organ is examined to make it a complete autopsy. Clinical or pathological autopsies are performed to gain insight into new pathologies, diagnose a specific disease, or for research purposes. It aids in determining the medical diagnosis that was uncertain or unclear before the patient's death. Autopsies are necessary because the evolution of medicine is reliant on them. [2]

The World Health Organization defines sudden death as a death that occurs within 24 hours of the beginning of symptoms. This gap, however, is too long for most doctors and pathologists where many consider death within 1 hr from the onset of illness. [3]

The role of a forensic pathologist is highly significant as providing the cause of death in such an undiagnosed cases which can contribute to the improvement of clinical and or surgical management of such patients, and help prevent unexpected deaths in the future. The gross morphological features like weight, size, shape, and others can be studied more accurately with autopsy than imaging studies. [2]Hence in this study, we are focussing on the possible role of adrenal gland pathologies in sudden death cases due to unknown etiology, all natural and unnatural deaths by observing gross and histopathology features. A few studies have been done in India and abroad in the field of adrenal/ suprarenal gland autopsy and hardly any recent work can be found out through thorough search. In an era where pathological autopsies are limited, the medico-legal autopsy will serve as a supplement to document the presence of adrenal disease in the study population.[2]

Objectives:

1. To study the incidence of adrenal gland pathologies in case of sudden death, both natural and unnatural causes.
2. To study the incidence and patterns of adrenal gland pathologies in relation to age, sex, laterality, manner of death.
3. To conclude the cause of death due to adrenal gland pathology in sudden death i.e. if it could be the terminal event.

Material and Methods

This is an autopsy based prospective study conducted between 2019 to 2021 at Department of Forensic Medicine and Toxicology, Govt. Medical College and Hospital, Aurangabad, Maharashtra. Ethical clearance was obtained from Institutional ethical committee prior to the study. The adrenal glands were procured from medico-legal autopsies of cases meeting the inclusion and exclusion criteria. Observations were noted in the predesigned case report proforma and from the histopathology report. Master chart including all the details, photographic records and histopathology slides have been maintained for future references.

Inclusion Criteria:

1. Cases of all natural and unnatural death.
2. Cases of all death due to unknown cause/ etiology (sudden death)

Exclusion Criteria:

1. Decomposed dead bodies.
2. Cases in which exact time of death is not known.
3. Dead bodies preserved in cold storage prior to the autopsy.

Result

The present study was conducted in the mortuary of department of Forensic Medicine and Toxicology of this institute. A total of 128 adrenal glands were examined for gross and histopathological changes out of the total medicolegal autopsies, which included right and left adrenal gland, of the age group from 1year to 75 years. We have studied all cases of natural and unnatural deaths, brought dead to our hospital. The number of males and females studied comprised of 38 males (59 %) and 26 females (41%). In our study, out of the 128 adrenal glands examined, majority of lesions were observed on histopathology i.e., 76 adrenals (60 %) as compared to 42 adrenals (33 %) that showed lesions on gross examination**.(Table 1)**

Out of the 42 gross adrenal lesions, maximum number of the lesions were observed in the age group between 21 to 30 years (n=16; 38%), followed by 41 to 50 years (n=11; 26%) and the least lesions were observed in the age group between 71 to 80 years(n=1; 2.3%). (**Table 2**)

Table 1: Incidence of gross and histopathology of adrenal lesions

Examination	Adrenal Findings		Total
	Lesions-Present	Lesions-Absent	
Gross	42	86	128
Histopathology	76	52	128

Table 2: Age wise distribution of incidence of gross adrenal lesions

	Age groups in years								Total
Gross Findings	**1 -10**	**11- 20**	**21-30**	**31-40**	**41-50**	**51-60**	**61-70**	**71-80**	
Congestion	2	1	9	4	9	0	2	0	27
Haemorrhage	2	1	3	0	1	2	0	1	10
Enlarged	0	0	4	0	1	0	0	0	5
Total	4	2	16	4	11	2	2	1	42

Out of the 76 adrenal lesions on histopathology, maximum number of the lesions were observed in the age group between 21 to 30 years (n=22; 29%), followed by 41 to 50 years (n=17; 22%) and the least lesions were observed in the age groups between 61 to 70 years and 71 years to 80 years (n=3; 4 % each). Furthermore it could be concluded that, people of age less than 40 years are more prone for adrenal hemorrhage (p-value 0.026) compared to other lesions. People of age more than 50 years are more prone for hypertrophy (p-value 0.0327) and atrophy (p-value 0.0327) compared to other lesions. (**Table 3**)

Table 3: Age wise distribution of Adrenal lesions on Histopathology

Histopathology Findings	Age groups in years								Total
	1 -10	**11- 20**	**21-30**	**31-40**	**41-50**	**51-60**	**61-70**	**71-80**	
Congestion	2	2	10	6	5	2	2	0	29
Haemorrhage	4	3	10	3	5	2	0	1	28
Adrenalitis	0	0	2	2	5	0	0	0	9
Hypertrophy	0	0	0	2	0	3	0	0	5
Atrophy	0	0	0	0	2	0	1	2	5
Total	6	5	22	13	17	7	3	3	76

Gross adrenal lesions were noted in 62% males and 38% females. Histopathology lesions were noted in 63% males and 37% females. Thus, the gross and histopathology lesions of adrenal gland were found to be more in males as compared to females. **(Table 4)** On gross, there were 33 %(n=42) adrenal lesions and these were present bilaterally with no difference between the involvement of right and left adrenal gland. However, among 60% adrenal histopathology lesions(n=76), left adrenal gland showed 55 % more lesions compared to right adrenal gland. **(Table 5)**

Table 4: Gender wise distribution of gross and histopathology lesions of adrenal gland

Examination	Gender		Total
	Male	Female	
Gross	26 (62%)	16 (38%)	42
Histopathology	48(63%)	28 (37%)	76

Table 5: Incidence of gross and histopathology lesion and adrenal gland side.

Examination	Side		
	Right	Left	Total
Gross	21	21	42
Histopathology	34	42	76

Our study comprised of 70% (n=45) unnatural cases and 30% (n=19) natural cases of the total autopsies conducted at our institute for examination of adrenal glands. Hence our study comprised more of unnatural cases than natural cases. **(Table 6)**

Table 6: Number of cases studied as per manner of death

Manner	No Of Cases	Percentage
Natural	19	30
Unnatural	45	70
Total	64	100

Our study shows 74% (n=31) adrenal gross lesions in unnatural deaths compared to 26 %(n=11) natural deaths. Majority of the lesions are seen in unnatural deaths than natural deaths except enlarged adrenals are found in natural deaths. **(Table 7)**

Table 7: Incidence of each gross lesions in relation to manner of death

		Gross			
		Congested	Enlarged	Haemorrhage	Total
Manner of Death	Natural	6	4	1	11
	Unnatural	21	1	9	31
Total		27	5	10	42

In our study, 67% (n=51) of adrenal histopathology lesions were seen in unnatural deaths and 33% (n=25) in natural deaths. Hence, majority of the adrenal histopathology lesions were found in unnatural deaths. **(Table 8)**

Table 8: Incidence of Adrenal histopathology lesions in relation to manner of death

Manner	Lesions (HP)	Percentage
Natural	25	33
Unnatural	51	67
Total	76	100

It shows maximum histopathology lesions in unnatural deaths except adrenalitis, hypertrophy and atrophy which is common in natural deaths. **(Table 9)** Majority of the lesions are found in unnatural deaths both on gross 73%(n=31) as well as histopathological 67%(n=51) examination. In case of natural deaths, females outnumbered males on gross examination (55% vs 45%: F vs M) while males outnumbered females on histopathological examination (64% vs 36%: M vs F).However, in cases of unnatural deaths there is male preponderance in both gross (68%) as well as histopathological (63%) examination**.** **(Table 10)**

Table 9: Incidence of each adrenal HP lesions in relation to manner of death

		HP Findings					Total
		Adrenalitis	Congested	Haemorrhage	Hypertrophy	Atrophy	
Manner of death	Natural	5	8	3	5	4	25
	Unnatural	4	21	25	0	1	51
Total		9	29	28	5	5	76

Table 10: Gender wise distribution of gross and HP Adrenal lesions in relation to manner of death

Examination	Total	Natural			Unnatural		
		Male	Female	Total	Male	Female	Total
Gross	42	5	6	11	21	10	31
Histopathology	76	16	9	25	32	19	51

Discussion

The adrenal glands were meticulously studied in different causes of death, both natural and unnatural cases, brought dead to our hospital, with an emphasis on macroscopic and microscopic features. The prospective study was conducted from October 2019 to October 2021 in the mortuary of department of Forensic Medicine and Toxicology of this institute. A total of 128 adrenal glands (including right and left adrenal gland) were studied in detail from 64 cadavers of which 38 were males and 26 were females, belonging to age group between 1 year and 75 years.

Out of the 128 adrenal glands, 33 % (n=42) adrenal glands showed lesions on gross. This is consistent with **Sarah et al.**[4]study where 32.25 % of adrenal glands showed lesions on gross. In our study, 60 % (n=76) of the adrenal glands showed lesions on histopathology, which is lower than the **Sarah et al.'s**[4]study which was 80 %.As per **P. Yadav et al.**[5]study, out of 250 adrenal glands, 15.20 % (n=38) showed adrenal pathologies which is lower than our study. Also **Kuntal Roy et al.**[2]study, 38.7 % (n=41) of the 106 autopsy cases showed adrenal lesions under histopathology which is also lower than our study.

It was observed in our study that the incidence of gross adrenal lesions were higher among the age groups of 21-50 years (n=31; 74 %) while the incidence was least among 71-80 years (n=1, 2.3%).Also, on histology adrenal lesions were higher among the age groups between 21 and 50 years (n= 52; 68%). This is consistent with study of **Kumari et al.**[6]i.e. 75% of lesions were common between age group 20-40 years with mean age of 36 years. It is also consistent with **Dongre et al.**[7] where the majority of adrenal lesions were seen in the third to sixth decade, i.e. 97.22 %, and the least was observed in the elderly age group, i.e. 2.78 %.The mean age of incidence of lesions was 34.3 ± 15.5 years in **Liao CH et al.**[8]studies which further supports our study. In addition, **Kuntal et al.**[2]study also resembled with our study in which 79% lesions were observed in the age group between 31 years and 60 years with mean age 57.32 ± 15.8 years. Moreover when co-relation between the age group and each of the histopathological lesions was plotted in this study , the p-value was 0.000 which further concluded that, people of age less than 40 years are more vulnerable for adrenal hemorrhage(p-value 0.026) compared to other lesions. People of age more than 50 years are more prone for hypertrophy (p-value 0.0327) and atrophy(p-value 0.0327) compared to other lesions. The age group with higher incidence of adrenal lesions in our study may be due to the fact that it is the most active period of life responsible for stress, trauma, infections etc. leading to higher incidence of adrenal lesions.

Males showed majority of adrenal gross lesions (i.e. n=26; 62%)as well as histopathology lesions (n=48; 63%) which is consistent with studies of **Sarah et al.,**[4]**Dongre et al.,**[7] **Nayak et al.**[9]and **Kuntal et al.**[2]studies. However in contrast to our study where 38 % females showed adrenal lesions on gross and 37% females showed histopathology lesions, **P. Yadav et al.**[5]study showed a female preponderance of 22.90 % with lesions in 4 out of 61 females against males of 12.4% with lesions in 24 out of 189 males. The study of **Kumari et al.**[6]also showed female preponderance of 62.5% against 37.5% males**.** The male preponderance in our study could be due to the higher male population in Maharashtra. However no significant link could be established between gender and incidence of gross and histopathology lesions where the p-value was 0.159 for incidence of gross lesions and gender and p-value was0.052 for incidence of histopathology lesions and gender.

Out of the 76 adrenal lesions on histopathology, 42 (55 %) left adrenal glands were more affected than 34 (45%) right adrenal glands. Moreover, out of 38 cases with adrenal lesions, 27 cases (71%) were bilaterally involved and 11 (29 %) were unilaterally involved. This almost resembled with **Nayak et al.**[9] **study** with 20% unilateral involvement of which 12% of left adrenal gland were affected than 8% right adrenal gland. Our study is in contrast to the study of **P. Yadav et al.**[5]study, where 15 (39.47%)out of 38 right adrenal gland was more affected than 2 (5.26 %) out of 38 left adrenal glands. Out of 38 cases, 21(55.26 %) were bilaterally involved. The right side was the predominant site of involvement (n=59; 76.6%) in **Liao et al.**[8]study. **Kumar et al.,**[10]and **Ahmed et al**[11] found equal involvement of both sides in their study of adrenal glands. This inconsistency in laterality in our study of can be explained as follows: according to several literatures, the right adrenal is mostly involved in trauma associated with other injuries,

while haemorrhages are also observed in other non-traumatic cases such as burns, hanging etc. Hence, our study includes both traumatic and non-traumatic cases, with non-traumatic cases outnumbering traumatic cases which does not account to right adrenal involvement in our study.

While considering manner of death, 68 %of the adrenal histopathology lesions were seen in unnatural deaths as compared to 32% lesions in natural deaths. This is almost resembling with **Sarah et al.**[4]study, where lesions were present in 59% of unnatural deaths and 22% of natural deaths. **Yadavet al.**[5]study also supports our study in which 83.57% of unnatural deaths showed lesions compared to 14.29% of natural deaths. **Nagy et al.**[12]study also shows higher incidence among unnatural deaths than natural deaths.

Conclusion

The present study concluded, incidence of histopathology lesions were prominently observed than the gross lesions. It shows that histopathological studies are more reliable in detecting or appreciating adrenal changes than gross examination alone. Majority of the adrenal gland lesions were detected in the age group of 21-50 years on gross (74 %) and histopathology (68%) examination. Most of the gross and histopathology lesions were found in unnatural deaths while On histopathology, majority of the adrenal glands (50-100%) were affected in deaths due to snakebite, hanging, incomplete abortion, rupture gravid uterus, septicemia due to cellulitis, burns, drowning, coronary artery disease, poisoning.

Ethical Clearance: Ethical clearance was taken from Institutional ethical committee of Govt. Medical College and Hospital, Aurangabad, Maharashtra

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