

An Autopsy Study to Evaluate Time Since Death from Organs Weight and Physical Parameters

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Abstract

Context: Time since death (TSD) is very important opinion in every post mortem examination. In every case, lawyers will try to exclude the evidences as they are not within range of time since death. *Aims:* To evaluate time since death from decrease in body weight, organs weight, BMI (Body Mass Index) and BSA (Body Surface Area) in percentage. *Methods and Materials:* This is prospective study comprised of 300 cases randomly selected from cadavers brought for autopsy at mortuary of Government Hospital, Rajkot from Jan-2012 to May-2013. Based on time since death, cases are classified as fresh cases having TSD within 6 hours, 1-3 days, 3-5 and more than 5 days respectively. Change in body weight, organs weight, BMI and BSA were studied in these TSD range. *Conclusion:* Changes in body weight, organ weight, BMI and BSA can be used as on table rapid tool to evaluate TSD.

Keywords: TSD (Time Since Death); Organs Weight; Decomposition; BMI (Body Mass Index); BSA (Body Surface Area).

Introduction

Time since death is very important opinion in every case of post mortem examination. It is calculated from various post mortem changes of the body which are grouped as immediate, early and late changes. Cooling of body, rigor mortis, post mortem lividity are common day to day parameters used to estimate TSD in fresh cases. Process of decomposition in accordance with TSD is divided as early decomposition characterised by various post mortem changes like marbling, peeling of epidermis, accumulation of gases etc (18 to 36 hours) and late post mortem changes like adipocere formation (3 weeks to 3 months) and mummification (3 months to 1 year). Opinion of TSD is based on combination of post mortem changes which are distributed over the range and there is no numerical parameters to

decide it. In every case, lawyers will try to exclude the evidences as they are not within range of time since death. Weak opinion regarding TSD will benefit the accused and causes injustice. In this study, an attempt is made to include new numerical parameters like decrease in body weight and organs weight along with post mortem changes to opine about TSD. Differential rate of decomposition of various organs are also studied.

Material and Method

This study was conducted on 300 subjects randomly selected from cadavers brought for autopsy at mortuary of Government Hospital, Rajkot from Jan-2012 to May-2013. Cases in which organs were injured, bodies having disease affecting body weight or organs weight, having congenital anomalies of organ, and cases in which bodies were mutilated or damaged by creature to any extent were excluded. Brain, heart, lungs, liver, spleen and kidneys were the organs included in this study. Standard autopsy protocol and procedure as described in standard textbooks [1-5] were employed for removal of various organs. The body and organs were weighed using electronic weighing machine. In decomposed cases,

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organs were weighed till their architecture was intact. Body length was measured from top of head to heel with measure tape by measuring distance between wooden blocks placed at both ends. BMI [6-7] and BSA [6-7] were the physical parameters that were derived using DuBois formula from Body weight and length.

Accurate TSD was obtained from history of relatives, police papers and post mortem changes. To correlate TSD with body weight and organ weight, we have divided TSD in fresh cases(FC) having TSD within 6hours and decomposed cases with TSD within 1-3days, 3-5days and >5days.

Result and Discussion

Cases are divided by considering TSD as Fresh cases (FC) having TSD within 6hours and decomposed cases with TSD within 1-3days, 3-5days and >5days. Fresh cases are maximum in number (80% of total cases) and values of their physical parameters and organs weight are considered as normal values for adults in Rajkot region. Out of all decomposed cases, maximum number of cases are with TSD within 3-5 days (10%), followed by cases with TSD within 1-3 days (6.4%) and cases with TSD more than 5days(3.6%) (Table 1).

Mean of body weight in fresh cases is considered as normal weight of adult in Rajkot region and is taken as 100%. Its value 59.36Kgs is approximately the same as average weight of adult in Indian population [6-7]. Weight of all organs are also approximately same as normal weight of organs in Indian population [1-5]. As TSD increases, significant decrease in body weight as well in organ weight is noted. They can be used as rapid on table tool to evaluate TSD. Body weight is 61.06% in cases with TSD within 1-3days, 53.97% in cases with TSD within 3-5 days and 42.48% in cases with TSD more than 5 days.

Body length does not shows significant variation with TSD. BMI [6-7] and BSA [6-7] are physical

parameters which are dependent on body weight and body length, so they shows changes in accordance with body weight. BMI is 63.59% in cases with TSD within 1-3 days, 54.82% in cases with TSD within 3-5 days and 41.66% in cases with TSD more than 5 days. BSA is 80.24% in cases with TSD within 1-3 days, 76.54% in cases with TSD within 3-5 days and 70.37% in cases with TSD more than 5 days (Table 2).

Out of all organs brain and spleen are the earliest organs to decompose. Weight of brain is not available in cases with TSD is more than 1day. Weight of spleen is reduced to 50% of its normal values in cases where TSD is within 1-3 days and is not available in cases with TSD>3days. Organs like liver and kidneys decomposes late as compared to organs like brain and spleen and their rate of decomposition is also less. Weight of liver is 60.99% in cases with TSD within 1-3days, 48.89% in cases with TSD within 3-5 days and 33.23% in cases with TSD more than 5days. Rate of decomposition of both kidneys are identical. Weight of kidneys are 60% of its normal values in cases with TSD within 1-3days, 57% of its normal values in cases with TSD within 3-5days and 50% in cases with TSD more than 5days. Lungs and heart decomposes late in our study. Weight of heart is reduced to 72.95% of its normal values in cases with TSD within 1-3days, 57.48% in cases with TSD within 3-5 days and 47.85% in cases with TSD more than 5days. Rate of decomposition of both lungs are identical. Weight of both lungs are 75% of its normal values in cases with TSD within 1-3 days, 63% in cases with TSD within 3-5days and 47% in cases with TSD more than 5days (Table 3).

We could not find any such study for comparison. However, every standard textbook of forensic medicine mentions that the organs composed of muscular tissue and those containing large amount of fibrous tissue resist putrefaction longer than the parenchymatous organs. We found similar findings in our study. In our study, brain, liver, spleen and kidneys were early to decompose while heart and lungs were late to decompose.

Table 1: Distribution of cases in relation to TSD

TSD (Time since death)	No. of cases	% out of total cases
<6hours (Fresh Cases)	250	80%
1-3 Days	16	6.4%
3-5 Days	25	10%
>5 Days	09	3.6%
Total	300	100%

Table 2: Mean of physical parameters in relation to TSD

TSD	Mean body weight		Mean body length	Mean of BMI		Mean of BSA	
<6hours	59.36 kg	100%	161.32	22.80	100%	1.62	100%
1-3days	36.25 kg	61.06%	158.37	14.50	63.59%	1.30	80.24%
3-5 days	32.04kg	53.97%	160.84	12.5	54.82%	1.24	76.54%
>5 days	25.22kg	42.48%	163.00	9.5	41.66%	1.14	70.37%

Table 3: Mean of organs weight in relation to TSD

Time since death	Mean weight of brain	Mean weight of heart	Mean weight of right lung	Mean weight of left lung	Mean weight of liver	Mean weight of spleen	Mean weight of right kidney	Mean weight of left kidney
Fresh cases	1229.07	303.01	439.12	384.19	1296.32	113.04	127.69	115.28
1-3 days	NA	221.06 (72.95%)	335.00 (76.28%)	288.81 (75.10%)	790.75 (60.99%)	50.75 (44.89%)	76.18 (59.66%)	71.68 (62.71%)
3-5 days	NA	174.20 (57.48%)	277.88 (63.28%)	245.24 (63.83%)	633.88 (48.89%)	NA	73.00 (57.16%)	66.80 (57.94%)
>5 days	NA	145.00 (47.85%)	205.33 (46.57%)	189.11 (49.22%)	430.77 (33.23%)	NA	52.22 (40.895)	47.33 (41.05%)

Conclusion

Decomposition is a process that progresses externally (Body weight) as well as internally (Organ weight) simultaneously. As TSD advances, body weight and organs weight decreases. Out of all physical parameters body weight and BMI show significant decrease with TSD. As BMI is an index which is directly proportional to body weight it shows significant changes in accordance with bodyweight. Brain and spleen decomposes earlier. Brain is completely decomposed in cases with TSD more than 1days. Spleen is reduced to 50% of its normal weight by end of 1day after death and is completely decomposed in cases with TSD more than 3days. Organs like liver and kidneys are next to decompose and their rate of decomposition is less as compared to brain and spleen. Lungs and heart decomposes late as compared to other organs in this study. This differential rates of decomposition of various organs as well as changes in body weight, BMI and BSA can be used as on table tool to evaluate TSD.

References

1. Reddy KSN. The Essentials of Forensic Medicine and Toxicology. 32nd ed. Hyderabad: K Suguna Devi. 2013; p.105-115,161-164,642.
2. ModiJP. Textbook of Medical jurisprudence and Toxicology. 24th ed. Gurgaon: Lexis Nexis. 2012; p.303-305,348-350.
3. Vij K. Textbook of Forensic Medicine and Toxicology: Principles and Practise. 5th ed. Gurgaon: Reed Elsevier India Pvt. Ltd. 2011; p. 20-23,89-94,584.
4. Pillay VV. Textbook of Forensic Medicine and Toxicology. 15th ed. Hyderabad: Paras Publication. p. 136-142,152-166.
5. Nandy A. Principles of Forensic Medicine including Toxicology 3rd ed. Kolkata: New central book agency ltd. p.262-272, 288-297.
6. ParkK. Park's textbook of preventive and social medicine. 23rd ed. Jabalpur: Bhanot Publications. p.399,632.
7. Sundarlal. Textbook of community Medicine. 3rd ed. New Delhi: CBS Publishers. p.171,572.