Original Research Article

AUTOPSY-BASED EVALUATION OF MORTALITY PATTERNS IN YOUNG ADULTS- EXPERIENCE IN A TERTIARY CARE CENTER

Martina V.[1], Sangeetha A.[2], Narmadha R.[3]

[1]Associate Professor, Department of Pathology, Stanley Medical College, Tamilnadu, India
[2]Associate Professor, Department of Pathology, Stanley Medical College, Tamilnadu, India
[3]Associate Professor, Department of Pathology, Kilpauk Medical College, Tamilnadu, India

A B S T R A C T

Background: Young adult mortality has major social implications because of years of life lost. The causes differ between the paediatric and elderly populations and include preventable conditions. This study aimed to assess the age-sex distribution of autopsy cases in adults aged 18–30 years, determine the histopathological patterns of death, and identify preventable toxicological and pulmonary causes.

Materials and Methods: This retrospective study was conducted in the Department of Pathology of a tertiary care hospital from January 2025 to December 2025. Seventy-five medicolegal autopsy cases were evaluated. Hematoxylin and eosin–stained sections from the tissue blocks were examined microscopically. The cause of death was confirmed by histopathological examination. Demographic data were recorded, and the causes were grouped based on the pathological diagnosis.

Results: Among the 75 cases, males constituted 67 (89.3%) and females 8 (10.7%), with a mean age of 24.9 years. Paraquat poisoning (acute tubular necrosis) was the most common cause in 19 (25.3%) patients. Excipient lung disease and cardiovascular pathology accounted for 17 (22.7 %) cases each. Pneumonia was identified in seven (9.4%) cases. No sufficient findings were observed in 12 (16%) patients. Malignancy and septic shock were noted in two (2.6%) and one (1.3%) case, respectively. Toxicological and pulmonary causes comprised nearly half of all deaths.

Conclusion: Young adult mortality in this cohort was predominantly male and driven by toxicological and pulmonary causes rather than cardiac conditions, highlighting the importance of autopsy-based evaluation in identifying preventable deaths and guiding public health strategies.

Keywords: Adult, Autopsy, Cause of Death, Paraquat Poisoning, Pulmonary Disease.

INTRODUCTION

Young adulthood is a very important phase of life, with significant life transitions that affect long-term health and social trajectories. Mortality affects society in terms of lost life years and disturbed life trajectories. Unlike mortality in childhood and old age, young adult mortality is influenced by behavioural, environmental, and biological factors, such as obesity, tobacco consumption, drug and alcohol abuse, violence, physical inactivity, and socioeconomic inequality.[1,2] Worldwide, young adult mortality is caused by preventable conditions such as accidents, violence, suicide, substance abuse, and infections. In low- and middle-income countries, mortality has been influenced by urbanisation, with an increasing number of non-communicable diseases and unnatural deaths.[3] In India, young adults are responsible for workforce productivity; early deaths have a significant impact, and the causes of mortality in the young adult group are road traffic injuries, self-harm, poisoning, alcohol-related illnesses, and infections.[4,5]

Variations occur according to sociocultural practices and healthcare accessibility, with agricultural areas having higher pesticide-related deaths and urban areas having higher substance abuse deaths.[6,7] A medico-legal autopsy is a process of determining the cause of death through examination and investigation. An autopsy is a diagnostic procedure that reveals patterns and confirms the diagnosis. In young adults, autopsy reveals myocarditis, cardiomyopathy, thromboembolism, and toxic exposure as causes of sudden death. Medico-legal autopsies require histological and toxicological evidence.[8,9] Histopathological examination helps determine the cause of death when gross examination is insufficient to do so. Histopathological examination confirms the presence of inflammation, infection, and toxic changes. Microscopic examination helps distinguish pulmonary diseases and reveals changes in organs due to poisoning.[10,11] Pulmonary causes of death in young adults include infection, aspiration, and thromboembolism, and aspiration is a consequence of substance abuse. Histopathological analysis is used for the diagnosis of this disease.[11,12] Toxicological causes are important factors in the deaths of young adults, and gender patterns reveal differences in mortality rates, with males having higher trauma and substance abuse-related deaths and females having different patterns. Age and sex analyses help in identifying the vulnerable groups for preventive measures.[13,14] There are only limited studies available for young adults aged 18-30 years, as the data are pooled for all age groups. The integration of forensic pathology, histopathology, and toxicology allows for a thorough analysis.[15] Because the 18-30 age group is so significant, a systematic analysis of autopsy results is essential, and age-gender distribution patterns help in understanding the dynamics of mortality.

Aim: To assess the age and sex distribution of autopsy cases in adults aged 18-30 years, determine patterns of death based on histopathological examination, and identify preventable causes of mortality, focusing on toxicological and pulmonary conditions.

MATERIALS AND METHODS

This retrospective descriptive study was conducted in the Department of Pathology of a tertiary care hospital from January 2025 to December 2025. Ethical approval was obtained from the Institutional Ethics Committee before the initiation of the study.

Inclusion and Exclusion Criteria
This study included all medicolegal autopsy cases involving individuals aged 18-30 years conducted during the study period. Decomposed bodies that could not be evaluated histopathologically were excluded.

Materials
The materials used in this study included haematoxylin and eosin-stained slides and paraffin-embedded tissue blocks retrieved from the departmental archives.

Methods
All eligible autopsy records were reviewed, and 75 autopsy cases met the inclusion criteria. Hematoxylin and eosin-stained slides and tissue blocks embedded in paraffin were taken from departmental archives. The cause of death was confirmed and categorised according to histopathological findings. Demographic details, including age and sex, were recorded. The causes of death were grouped and analysed according to the pathological diagnosis. Data are presented as frequency, percentage, and mean.

RESULTS

Male patients were predominant, 67 (89.3 %), compared with female patients, 8 (10.7 %), and the mean age of the patients was 24.9 years. [Table 1]

Table 1: Demographic profile of study participants

		N (%)
Sex	Male	67(89.3%)
	Female	8(10.7%)
Mean age (in years)		24.9

Paraquat poisoning was the most common cause of death 19(25.3%), followed by excipient lung disease 17(22.7%), cardiovascular pathology (CAD/aortic disease); 17(22.7%), unknown cause or insufficient findings 12(16%), pneumonia 7(9.4%), Malignancy 2(2.6%), and septic shock 1(1.3%). Toxicological and pulmonary causes accounted for nearly half of all deaths [Table 2]

Table 2: Distribution of cause of death among study participants

		N (%)
Cause of Death	Paraquat poisoning (acute tubular necrosis)	19(25.3%)
	Excipient lung disease	17(22.7%)
	Cardiovascular pathology (CAD/aortic disease)	17(22.7%)
	Pneumonia	7(9.4%)
	No sufficient findings	12(16%)
	Malignancy	2(2.6%)
	Septic shock	1(1.3%)

DISCUSSION

In our study, male predominance was found in young adult autopsy cases, and the study population included persons belonging to the specified young adult age group of 18-30 years, with an average age distribution in the mid-twenties. Male predominance in young adult autopsy cases has been reported in previous studies, and the 21-30 age group accounts for the largest proportion of deaths. Yadav et al. found the male-to-female ratio to be 2.06:1 in the 21-30 age group (687 males vs. 202 females).[16]

Lad et al. (2025) found a male-to-female ratio of 3:1, with 75% males of the same age group, and Gurung et al. (2025) found a 75% male composition in 469 autopsies.[17,18] Saadi et al. found the mean age to be 26.47 years, and Jain et al. found it to be 33.6 years in young adults. [19,20] Ray et al. found that males have a higher risk of death (aHR 1.44).[21] All findings favour the dominance of males in young adult mortality.

In our study, toxicological and pulmonary causes accounted for a large proportion of deaths in young adults. Paraquat poisoning was identified as the leading cause of death. Pulmonary pathology, specifically excipient lung disease and pneumonia, contributed significantly to mortality. Cardiovascular causes, specifically coronary artery and aortic pathologies, were also well represented. Studies have shown that cardiovascular causes, and not toxicological causes, are the common mortality pattern in young adults, which is different from the findings of our study on paraquat poisoning. According to Saadi et al., 72% of 137 Tunisian cases aged 18-35 years were cardiac deaths, of which ischaemic heart disease contributed 32.32%.[19] Daş and Buğra also identified cardiac aetiology in 87.9% of 66 Turkish cases aged 18-35 years, of which atherosclerotic coronary artery disease was the main cause (36.3%).[22]

Coronary artery disease (45.8%) and acute myocardial infarction (35.6%) were the major causes of sudden death reported by Kanani.[23] Turning to pulmonary pathology, Patil et al., in a study of 218 autopsies in adults, reported pneumonia in 22.2% of cases, although pulmonary oedema and haemorrhage were more common (21.5% and 38%, respectively).[24] In the case of paraquat poisoning, recent studies by Sarma et al. and Keche et al. support extensive pulmonary damage as the major pathological finding, although these are specialised cases and not representative of the general mortality rates in young adults.[25,26] The sociodemographic factors, occupational exposure to agrochemicals, referral bias to tertiary centres, and variations in inclusion criteria might be the reasons for differences observed across the studies.

No medicine treats paraquat poisoning, and the chemical causes damage by generating harmful free radicals. In the lungs, damage appears as swelling, bleeding, damaged air sacs, and tissue thickening.

Since paraquat is widely used in farming, its accessibility may explain why it is a major cause of death here. Some deaths could not be explained by a standard autopsy, highlighting the limitations of traditional techniques. Advanced tests, such as molecular analysis and toxicology, could help find more answers in future cases.

In our study, a proportion of cases remained inconclusive because of a lack of adequate findings on histopathological analysis. A lower proportion of deaths was attributed to malignancy and septic shock, indicating the presence of underlying medical conditions in this age group. Underlying medical conditions have a significant role in mortality rates among young adults, and septic shock and malignancy-related deaths remain important causes of mortality in this group. Ramos et al. analysed an autopsy-based study of 504 deaths in adolescents and young adults with chronic diseases, concluding that neoplasias accounted for 54.2% of deaths, with 41.3% discordance between clinical and autopsy diagnoses.[27]

For septic shock, Zangrillo et al. analysed 361 young patients (≤55 years) with septic shock, showing a 28-day mortality of 29-39.5%, with a higher mortality rate in males.[28] Bouza et al. observed sepsis incidence of 16.4 cases/100,000 in young adults aged 20-44 years, with 24% in-hospital mortality and 60% of patients with associated comorbidities.[29] The results indicate that malignancy and septic shock are still important in young adults with underlying conditions, while mortality rates differ depending on patient characteristics and comorbidities.

In our study, preventable causes, such as toxicological exposure and pulmonary conditions, were more common than heart-related causes and contributed significantly to the mortality rate of young adults. According to Cafferky et al, accidental poisoning and exposure to noxious substances emerged as the common denominators of the higher mortality rate among young adults in the US between 1999 and 2021, thus accounting for the 54.1% rise in overall mortality.[30]

Modi et al. observed pulmonary diseases in 17.3% of 150 cases, and Jain et al. recorded respiratory causes in 21.3% of 103 young adults who suffered sudden deaths.[31,20] Toxicological causes (poisoning and asphyxia) contributed to 9.3% of the cases in Modi's study.[31] Such observations highlight the importance of preventable causes of sudden death apart from conventional cardiac causes. Excipient lung disease occurs when crushed pills are injected into the veins. Talc or microcrystalline cellulose lodges in lung vessels, causing inflammation and blockage. In the long term, this leads to increased lung blood pressure and clot formation. Recognising this condition highlights the role of drug abuse in young adult deaths.

CONCLUSION

Many deaths among young adults aged 18-30 occur from noncardiac causes, particularly lung issues and substance poisoning. The male predominance might be due to the occupational and lifestyle factors. The discovery of preventable deaths from paraquat poisoning and drug-related lung problems highlights the need for stricter regulations and increased public awareness. Autopsy studies remain valuable for understanding mortality and developing effective prevention strategies.

REFERENCES

1. Rod NH, Davies M, de Vries TR, Kreshpaj B, Drews H, Nguyen TL, et al. Young adulthood: a transitional period with lifelong implications for health and wellbeing. BMC Glob Public Health 2025;3:25. https://doi.org/10.1186/s44263-025-00148-8.

2. Rogers RG, Hummer RA, Krueger PM. 14 adult mortality. Handbooks of Sociology and Social Research, Cham: Springer International Publishing; 2019;17:355–81. https://www.academia.edu/download/6112180/handbook_of_population.pdf#page=299.

3. Ndubuisi NE. Noncommunicable diseases prevention in low- and middle-income countries: An overview of health in all policies (HiAP). Inquiry 2021;58:46958020927885. https://doi.org/10.1177/0046958020927885.

4. Rao C, Gupta A, Gupta M, Yadav AK. Premature adult mortality in India: what is the size of the matter? BMJ Glob Health 2021;6:e004451. https://doi.org/10.1136/bmjgh-2020-004451.

5. Liu L, Villavicencio F, Yeung D, Perin J, Lopez G, Strong KL, et al. National, regional, and global causes of mortality in 5-19-year-olds from 2000 to 2019: a systematic analysis. Lancet Glob Health 2022;10:e337–47. https://doi.org/10.1016/S2214-109X(21)00566-0.

6. Baddeliyanage R, Enns A, Vansteelandt A, Abele B, Kouyoumdjian F, Schleihauf E, et al. Substance-related acute toxicity deaths by area-based characteristics: A descriptive analysis of a national chart review study of coroner and medical examiner data. Int J Ment Health Addict 2025;23:2769–92. https://doi.org/10.1007/s11469-024-01259-3.

7. Dos Santos JCP, Valli JB, Sesse NS, Mackenzie-Ross S, Zandonade E, Ayres LR, et al. Sociodemographic characteristics and exposure patterns of pesticide-related cases reported to a poison service center in Brazil between 2012 and 2016. Arch Environ Occup Health 2021;76:494–503. https://doi.org/10.1080/19338244.2020.1848773.

8. Nahar K, Ali SMY, Hossain MI, Islam MS, Ahmad MR. Medicolegal autopsy in forensic practice: Determining cause and manner of death. Front Health Inform 2026:7820–6. https://doi.org/10.63682/fhi2910.

9. Salzillo C, Ciccone MM, Introna F, Santobuono VE, Solarino B, Marzullo A. Sudden cardiac death in the young: single-center study of Bari autopsy cases. Front Cardiovasc Med 2025;12:1630511. https://doi.org/10.3389/fcvm.2025.1630511.

10. Mukherjee B, Ropmay AD, Slong D, Das P, Patowary AJ, Khonglah Y, et al. Role of histopathology in determining the cause of death in medicolegal autopsies. Cureus 2025;17:e81055. https://doi.org/10.7759/cureus.81055.

11. Prakash D, Balaji RV, Raguram R, Narayanan S, Janarthanan V, Kumaran S. Excipient lung disease and fatal outcome among young adults: A case series on the hidden dangers of intravenous drug abuse in India. Ann Afr Med 2025;24:804–10. https://doi.org/10.4103/aam.aam_210_24.

12. Kaur M, Punia RPS, Mohamedali R, Chatterjee D, Bhagat R, Aggarwal P, et al. Foreign body pulmonary vessel embolism and granulomatosis in intravenous drug abuse: An autopsy study. Indian J Pathol Microbiol 2024;67:870–3. https://doi.org/10.4103/ijpm.ijpm_169_24.

13. Amine BM, Youcef A, Feriel R, Amel MI, Lahcène B, Abdellatif B. The value of toxicology in determining cause of death. A study of 400 autopsy cases. Studies Health Sci 2023;4:266–83. https://doi.org/10.54022/shsv4n1-028.

14. Harsh H, Kumar R, Naagar S, Buchade D, Chandra R. Demographic and causal analysis of medicolegal autopsies: A five-year retrospective study at a forensic medicine department in New Delhi, India. Int J Sci Res 2024:28–30. https://doi.org/10.36106/ijsr/5903849.

15. Singh JP, Tyagi S, Sharma A, Chanana A, Basra S. Digital pathology and AI in forensic medicine: advances, limitations, and medico-legal utility. Acad Med (San Franc) 2025;2. https://doi.org/10.20935/acadmed7799.

16. Yadav K, Mustafa khan, Kumar R, Chawla H, Jowel T, Yadav R. An epidemiological profile of medico-legal autopsies at a tertiary care center. Med-Leg Update 2024;24:27–31. https://doi.org/10.37506/35w8k164.

17. Lad K, Kagathara AS, Saradava SM. Observational analysis of unnatural deaths based on autopsy reports at a tertiary care center. Int J Pharm Qual Assur 2025;16(8):180-4. https://doi.org/10.25258/ijpqa.16.8.31.

18. Gurung S, Shrestha A, Shrestha S. Profile of medicolegal autopsies at a provincial hospital in Nepal. Med J Eastern Nep 2025;4:28–32. https://doi.org/10.3126/mjen.v4i01.80702.

19. Saadi S, Ben Jomaa S, Bel Hadj M, et al. Sudden death in the young adult: a Tunisian autopsy-based series. BMC Public Health 2020;20:1915. https://doi.org/10.1186/s12889-020-10012-z.

20. Jain S, Gupta S, Murthy AS, et al. Burden of sudden death in young adults: A one-year observational study at a tertiary care centre in India. Indian J Med Res 2025;162:453–9. https://doi.org/10.25259/IJMR_938_2025.

21. Ray JG, Guttmann A, Silveira J, et al. Mortality in a cohort of 3.1 million children, adolescents and young adults. J Epidemiol Community Health 2020;74:260–8. https://doi.org/10.1136/jech-2019-213365.

22. Daş T, Buğra A. Natural causes of sudden young adult deaths in forensic autopsies. Cureus 2022;14:e21856. https://doi.org/10.7759/cureus.21856.

23. Kanani J. Autopsy analysis of sudden deaths in adults: Causes and demographics from a one-year prospective study. Curr Health Sci J 2025;51:343–9. https://doi.org/10.12865/CHSJ.51.03.05.

24. Patil AG, Patil P, Nigudgi S. Spectrum of pulmonary lesions at autopsy. Indian J Forens Med Pathol 2020;13:495–500. https://doi.org/10.21088/ijfmp.0974.3383.13420.4.

25. Sarma B, Kumar Dash S, Rishikesh. Clinical and autopsy findings in Paraquat poisoning: A two-year retrospective study. J Forens Med Toxicol 2025;42:29–33. https://doi.org/10.48165/jfmt.2025.42.3.6.

26. Keche AS, Bhargava DC, Chaurasia JK, Vijaykumar S. Toxicohistopathology in Fatal Weedicide Poisoning: A Case Series. J Forens Med Toxicol 2025;41:253–9. https://doi.org/10.48165/jfmt.2024.41.2.43.

27. Ramos GF, Ribeiro VP, Mercadante MP, Ribeiro MP, Delgado AF, Farhat SCL, et al. Mortality in adolescents and young adults with chronic diseases during 16 years: a study in a Latin American tertiary hospital. J Pediatr (Rio J) 2019;95:667–73. https://doi.org/10.1016/j.jped.2018.06.006.

28. Zangrillo A, Morselli F, Biagioni E, Stella RD, Coloretti I, Moizo E, et al. Sex-related mortality differences in young adult septic shock patients. Signa Vitae 2022;19(1):50-56. https://doi.org/10.22514/sv.2022.017.

29. Bouza C, López-Cuadrado T. Epidemiology and trends of sepsis in young adults aged 20-44 years: A nationwide population-based study. J Clin Med 2019;9:77. https://doi.org/10.3390/jcm9010077.

30. Cafferky V, Sun S, Saadeh FB, Loucks EB. Identifying the changing landscape of younger adult mortality in the United States from 1999 to 2021. J Adolesc Health 2025;76:571–83. https://doi.org/10.1016/j.jadohealth.2024.11.247.

31. Modi RA, Patel MI, Patel MM, Padsala S, Chaudhary J. Autopsy findings in sudden death in adults: a study of 150 cases. Int J Res Med Sci 2020;8:1523. https://doi.org/10.18203/2320-6012.ijrms20201353.