Original Communication

A Cross Sectional Study of Pathological Changes in Lungs, Liver and Kidneys in Burns Cases Autopsied at G B Pant Hospital, ANIIMS, Port Blair, Andaman & Nicobar Islands

Siddesh Revpla Channabasappa[1a], Biswajit Dey[1b], Udayashankar Yadiyapur[2b]

Abstract

Introduction: Medico legal deaths including burns claim a substantial number of lives in Andaman & Nicobar Islands. 'A Cross Sectional Study of Pathological changes in Lungs, Liver and Kidneys in Burns Cases' was carried out at the Department of Forensic Medicine & Toxicology, G B Pant hospital, ANIIMS, Port Blair, A & N Islands. **Material & methods:** The present study was carried out for the period of 3 years from January 2015 to December 2017. Totally 100 cases with burns and scalds injuries brought to the mortuary for autopsy was the material for study and collection of tissues for histopathological examination.**Observations & Results:** In the present study, histopathological changes in lungs showed congestion, pulmonary edema, emphysematous changes, bronchopneumonia, interstitial pneumonitis, anthracotic pigment and carbon laden macrophages. In some of the cases intravascular thrombi, septic emboli, interstitial & intra alveolar haemorrhage were also observed. Diffuse alveolar damage or ARDS was observed in majority of the cases. Histopathological changes in liver showed congestion, fatty change, centrilobular necrosis, cloudy swelling, focal haemorrhage, necrosis, portal inflammation. Histopathological changes in kidneys showed ATN in majority of cases, cloudy degeneration, congestion, tubular casts and acute pyelonephritis in rest of the cases.**Conclusion:**The effect of burns on vital organs can be assessed through histopathological examination, which helps us to determine the post burn complications and helps in treatment of the victim in future.

Keywords: Medico legal autopsy, Burns, Scalds, Histopathological examination

Introduction:

There are 572 Islands in the Andaman & Nicobar group with an area measuring 8249 Sq. KM., among them only 32 islands are inhabited, Port Blair, being its capital city.

Medico legal deaths including burns claim a substantial number of lives in Andaman & Nicobar Islands.

Fire was perhaps, man's first double-edged sword, for throughout history, it has served as well as destroyed mankind. Burn injuries occur universally and have plagued mankind since antiquity till the present day. The circumstances of burns may be personal, domestic, occupational or social tragedy and more recently dowry death. In all societies including the developed and developing countries, burns constitute not only a major medical and psychological problem, but have also resulted in social and economic consequences.[1]

A burn is an injury which is caused by application of heat or chemical substances to the external or internal surfaces of the body which causes destruction of tissues.[2]

Every year more than 2 million people sustained burns in India, most of which (around 500000 people) are treated as outdoor patients. About 200000 were admitted in hospitals and 5,000 died. Thermal burns are

[1]Assistant Professor, [2] Associate Professor, [a] Department of Forensic Medicine & Toxicology, DM WIMS, Wayanad, [b]Department of Pathology, [c] Department of Forensic Medicine & Toxicology, ANIIMS, Port Blair, South Andaman

Correspondence: Dr. Siddesh Revpla Channabasappa
Mail- rcsiddesh@gmail.com
Contact: 9474268729

Received on 20.06.2019 | Accepted on 11.09.2019

more common incidents, which stands next to road traffic accidents in India. Mortality rate due to burns is much more than any other developed countries.[3]

Most of the victims succumb to the infections and their complications, if they survive the initial 24 hours. The burn injury causes devitalisation of the affected surface and produces extensive raw areas, which become moist due to exudation of plasma, forming a medium ideal for the colonization and proliferation of various types of microorganisms. The affected individual's immune system is depressed and this, compounded by the large cutaneous bacterial load, the possibility of gastrointestinal translocation, prolonged hospitalization and associated invasive diagnostic and therapeutic procedures, all contribute to sepsis.[4]

Most burns are caused by carelessness and appear to be preventable, while the rest of the cases are associated with smoking and alcohol. The face and hands are the most common sites of injury, followed by respiratory damage, with eye damage being the least common injury. Hot or corrosive substances account for two-thirds of all burns, with fire and flame accounting for one-fourth of cases.[5]

The major cause of death in the burn patients includes multiple organ failure and infection. This can be understood better with a pathological study of the burn victim's organs.[6]

The present study is an effort to identify the histopathological changes occurring in the lungs, liver and kidneys of victims died due to burns with the help of routine H & E stain. With the supports of available history from the relatives, hospital data, police inquest and postmortem examination findings, the post-exposure duration of survival in burns victims can be correlated with pathological findings of vital organs to find out the actual cause of death and mechanism of death at terminal events and their utility to predict diagnosis and betterment of treatment for patients in future. Hence a sincere attempt is made to study the histopathological changes in the organs of burn deaths. As there are only few studies conducted in this regard till now, it will be of immense help for further research.

Objectives of the Study:

1. To know the pattern of fatal thermal burns cases in relation to the age, sex & marital status.
2. To know the degree, cause & manner of death.
3. To know the Histopathological changes in lungs, liver and kidneys in fatal burns cases in relation to duration of survival.

Materials and Methods

All the cases of deaths due to burns & scalds brought to the mortuary, Department of Forensic Medicine & Toxicology, G B Pant hospital, ANIIMS, Port Blair, Andaman & Nicobar Islands for the period of 3 years from January 2015 to December 2017 was the material of the present study.

The specimens of lungs, liver and kidneys were collected and preserved in 10% formalin solution. The specimens were sent to the department of pathology for histopathological examination. The reports were collected.

The histopathological changes of each organ were noted and tabulated. These observations were correlated with the other similar studies.

Study Protocol:

a) Study design: Cross sectional

b) Study period: January 2015 to December 2017

c) Sample size: 100 cases of death due to Burns

Inclusion criteria:

All medico legal autopsies with the alleged history of burns & scalds, performed at the Department of Forensic Medicine, G B Pant hospital, ANIIMS, Port Blair, A & N Islands for the period of 3 years from January 2015 to December 2017 were included in the study.

Exclusion criteria:

- Thermal injuries caused due to exposure to cold (E.g.: Frostbite, Trench / Immersion foot)
- Electrical burns
- Postmortem burns

- Completely charred bodies, decomposed cases and unknown bodies
- The organs with the pre-existing diseases were excluded from the study

Results and Discussion:

In the present study, maximum number of cases were seen in between the age group of 21 to 30 years (36%) followed by age groups of 11 to 20 years (26%) and 31 to 40 years (24%). Out of 100 cases, 74 (74%) were females and 26 (26%) were males. So, the overall Male: Female ratio was almost 1: 3. Majority of the victims belong to rural area (68 %) followed by urban area (32 %), flame burns constituted 96% of burns followed by scalds which are 4%. Out of 100 cases 60 cases had dermo-epidermal burns (60%) and the remaining cases had epidermal burns (24%) and deep burns (16%). Majority of victims died with 91-100% of burns (26%) followed by 81-90% burns (20%), only two cases, which are autopsied had 21-30% of burns. It was observed that 12% of cases survived for 1 day, 8% of cases survived for 2 days, 14 % of them survived for first 72 hours, 34% of cases survived for 3 to 5 days, 17 % of cases survived for 5 to 7 days whereas 15% of them survived for 8 days or more. In majority of cases, cause of death was septicemia (46%) followed by hypovolemic shock (22%), toxemia (20 %) and neurogenic shock (12 %). Most common manner of death in burn injury was accidental (65 %) followed by suicidal (32 %) and homicidal (3 %).

Predominant histopathological changes in lungs: (Fig: 1, 2, 3&4)

Fig-1: Histopathological slide showing pulmonary congestion. (E & H stain; 10X)

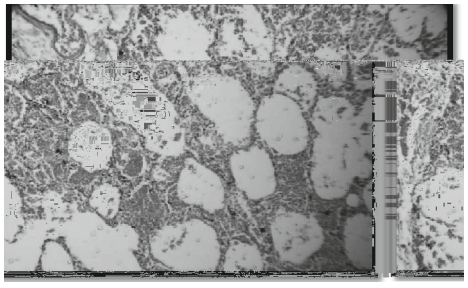


Fig-2: Histopathological slide showing pulmonary edema(E & H stain; 10X)

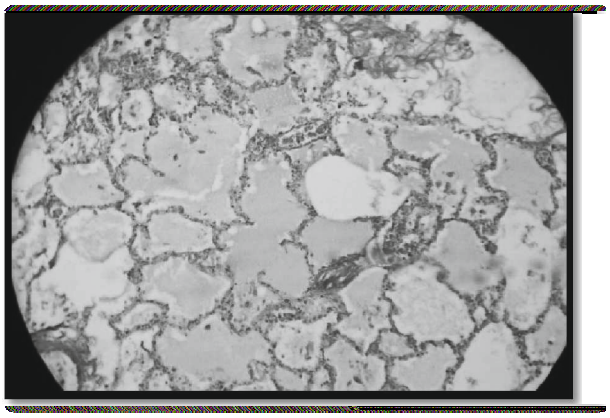


Fig-3: Histopathological slide showing of Diffuse Alveolar Damage in lungs (ARDS)(E & H stain; 10X)

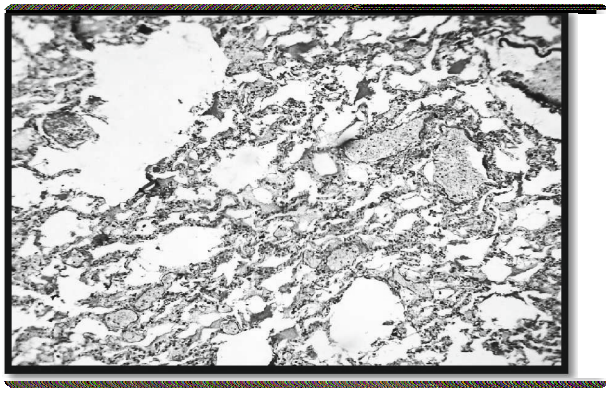


Fig-4: Histopathological slide showing anthracotic pigment in the lungs.(E & H stain; 10X)

In our study, maximum number of cases showed diffuse alveolar damage (ARDS) (22 %), the alveolar walls become lined with waxy **hyaline membranes**. Alveolar hyaline membranes consist of edema fluid mixed with

the cytoplasmic and necrotic epithelial cells. Fatal cases often have superimposed bronchopneumonia Predominantly congestion was observed in 14 cases (14%), pulmonary edema in 16 cases (16%), emphysematous changes were observed in 10 cases (10 %), bronchopneumonia was observed in 08 cases (8 %) and interstitial pneumonitis was observed in 4 cases (4%). Out of 100 cases anthracotic pigment and carbon laden macrophages were observed in 14 cases (14 %). Intravascular thrombi & septic emboli were observed in 08 cases (8%), interstitial & intra alveolar haemorrhage were observed in 4 cases (4%).

Wroblewsky P. et al (1985) found edema and necrosis of bronchial mucosa, recruitment of inflammatory mediators and obstruction of bronchial tract with the casts composed of mucus, tissue debris, neutrophils and fibrin and ARDS in 26 % of cases. All these findings were observed in the present study depending on the duration of survival of burns patients is consistent with this study.[7]

Toor AH et al (1990) observed diffuse alveolar damage in 16 (28.48%) patients and necrotizing interstitial inflammation in seven (21.21%) patients. So, these findings are consistent with the present study.[8]

Argamaso R. V. (1967) observed changes of pneumonitis in 6.66% of cases which is in correlation with the present study. He also observed changes of pulmonary edema in 70% of cases and varying degrees of pulmonary infarction or necrosis in 23.33% of cases. So, these findings are in contrast with the present study. Different durations of post burn survival maybe the cause of this discrepancy.[9]

Shinde AB and Keoliya AN (2013) observed the histopathological changes in lungs, showed pulmonary oedema in 61(55.45%) cases, atelectasis in 16(14.54%), interstitial haemorrhage in 42(38.18%), intra alveolar haemorrhage in 39(35.45%), interstitial pneumonitis in 30(27.27%), macrophages in 51(46.36%) and congestion in 81cases(73.63%), these findings are in contrast with the present study. Authors observed bronchopneumonia in 22 (20%) cases, emphysema in 19(17.27%) and ARDS in 32 % of cases, so these findings are consistent with present study.[10]

KSN Reddy (2013) mentioned that the histopathological changes of pigment laden macrophages can be present in certain cases. This observation is in accordance with the present study.[2]

Predominant histopathological changes in liver: (Fig: 5, 6, 7&8)

In our study, Congestion of the liver was observed in 40 cases (40 %). It was associated with generalized congestion of all internal organs and the cause of death was neurogenic shock due to burns and death within 24 hours (12 cases). It was observed that all cases showing changes of venous congestion had a minimum duration of survival of 0-72 hours. Fatty changes in the liver were observed in 16 cases (16 %). Fatty changes were centrilobular or perilobular and were scattered or diffused in distribution. Extent of fatty changes was related with higher extent of burnt body surface area. Cloudy swelling and loose cytoplasmic hepatic cells were observed in 08 cases (8 %). Cases showing centrilobular necrosis had a minimum duration of survival of 0-72 hours. Cases showing changes of portal inflammation were distributed widely in correlation with duration of survival from 25 - 72 hours to 8 days and more. Normal histology was observed in two cases (2 %).

Fig-5: Histopathological slide showing liver congestion(E & H stain; 10X)

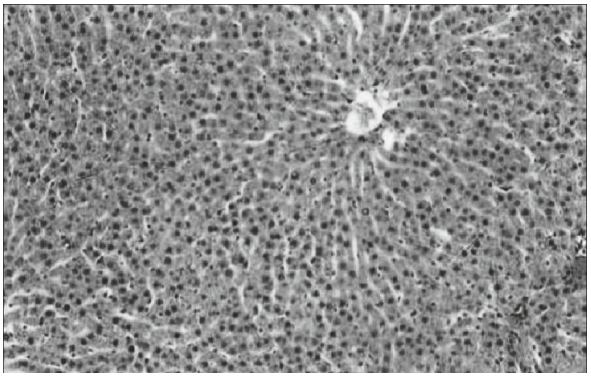


Fig-6: Histopathological slide showing Fatty change in the liver(E & H stain; 10X)

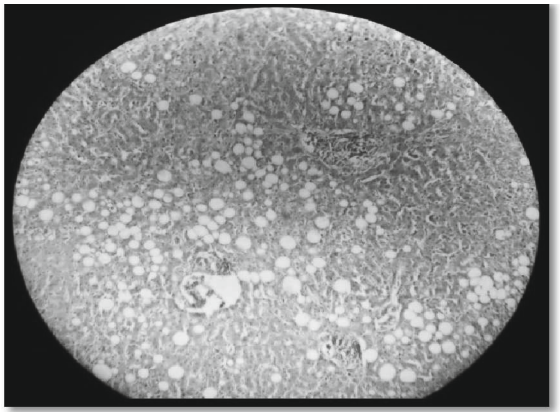


Fig-7: Histopathological slide showing portal inflammation in the liver

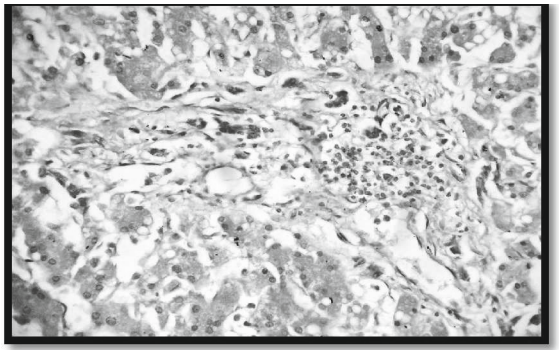
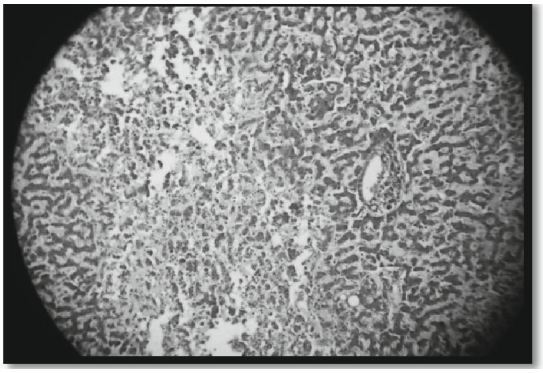


Fig-8: Histopathological slide showing Hepatic necrosis (centrilobular necrosis)(E & H stain; 10X)



Marc G. Jeschke (2011) observed changes of liver necrosis in 10-15% of thermally injured patients in his study. So, his study is consistent with the present study.[11]

G. Watson James (1950) observed evidence of fatty infiltration (18 %), cloudy swelling (11.5 %), increased pigments in the reticulo endothelial cells and focal necrosis (6.5 %) and congestion (45 %) in the liver substance. All the above changes are in accordance with the observations made in our study.[12]

Lars H. Evers (2010) observed changes of large intra hepatocytic fat droplets (22 %), centrilobular necrosis (16 %) and congestion (38%) in most burn cases. The above findings are in accordance with the observations noted in the present study.[13]

Shinde AB and Keoliya AN (2013) observed the histopathological changes in liver, 64 cases (58.18%) showed congestion of the liver. Fatty changes in the liver were observed in 17 cases (15.45%). Cloudy swelling and loose cytoplasm was observed in hepatic cells. So in this study congestion was slightly more compared to our study and other findings are in consistent with the present study.[10]

Predominant histopathological changes in kidneys: (Fig: 9, 10, 11&12)

In the present study histopathological changes in kidneys showed acute tubular necrosis in 42 (42 %), cloudy degeneration in 20(20 %) cases, congestion in 16(16 %) cases, tubular casts in 14(14 %) and acute pyelonephritis in 08 (8 %) cases.

Sevitt S (1956) observed changes of acute tubular necrosis in 59.30% cases and changes of cloudy swelling in 37.21% cases. So, thisstudy findings are slightly more compared to the present study, which may be due to difference in the post burn duration of survival.[14]

Dr Yan (1960) observed that the glomeruli exhibited consistent morphologic changes in most of the burn patients. The above observation is in accordance with the present study.[15]

Fig-9: Histopathological slide showing degenerative changes in the kidney(E & H stain; 10X)

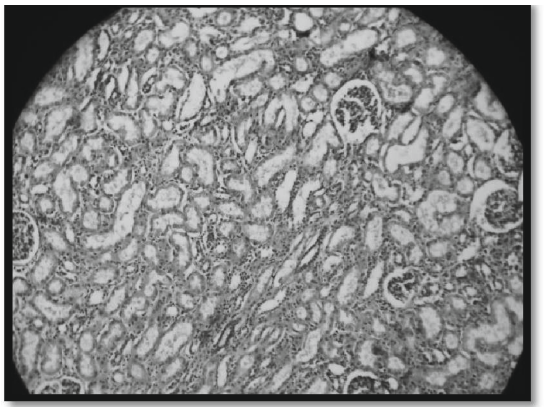


Fig-10: Histopathological slide showing cloudy degeneration in the kidney.(E & H stain; 10X)

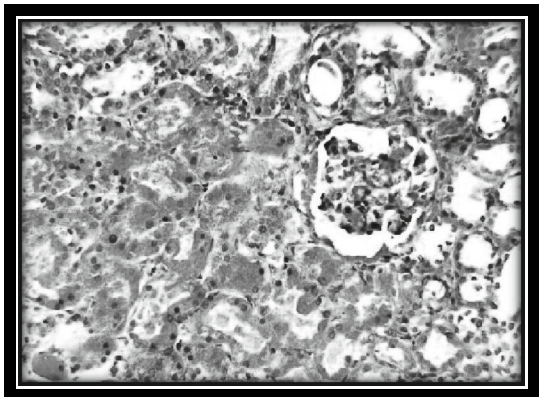


Fig-11: Histopathological slide showing acute tubular necrosis in kidney

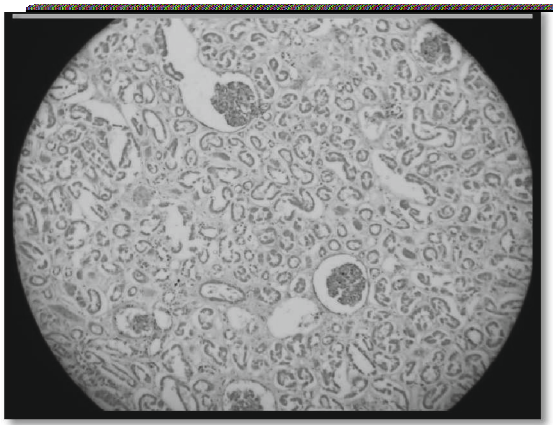
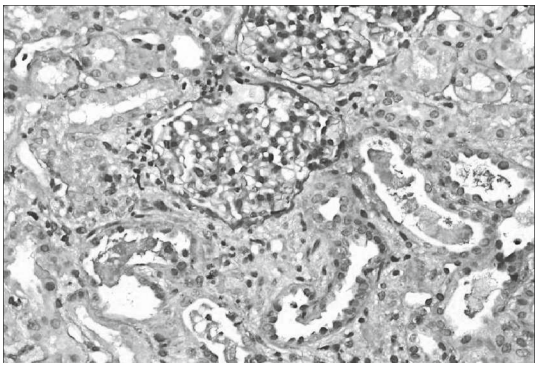


Fig-12: Histopathological slide showing acute tubular necrosis with tubular casts(E & H stain; 10X)



Argamaso R V (1967) observed changes of cloudy swelling in 10% cases whereas 33.33% cases had degenerative changes in the renal tubules. Remaining cases did not show any significant changes. Hence this study is consistent with the present study.[9]

Cernea Daniela et al (2005), in their study "Microscopic assays regarding the renal damage following a post-combustion shock", observed that the kidneys displayed tubular necrosis, fibrous micro-thrombi and infarct areas with H&E stain in majority of cases. These changes are in accordance with the observations made in the present study.[16]

Palmieri T et al (2010) observed changes of acute kidney injury in 53.3% of burns. So this study correlates with the present study.[17]

Shinde AB and Keoliya AN (2013) observed cloudy degeneration of kidneys in17 (15.45%) cases, tubular casts in 35(31.81%), acute pyelonephritis in 10(9.09%), regeneration of epithelium in 15(13.63%) & acute tubular necrosis in 18(16.36%). So this study correlates with the present study. Authors observed ATN in 16.36% of cases, so this finding is in contrast with the present study.[10]

KSN Reddy (2013) mentioned the changes of cloudy swelling and tubular necrosis in majority of cases of burns depending on the duration of survival of each patient. These changes are in accordance with the observations made in the present study.[2]

Coca SG et al (2007) observed acute kidney injury in 26.6% of burns. So, this study is in

contrast with the present study, which may be due to difference in the post burn duration of survival.[18]

Steinwall I et al (2008) observed changes of acute kidney injury in 24% of burns. So this study is contrast with the present study, which may be due to difference in the post burn duration of survival.[19]

Conclusion:

Pursuing to the aims of the study, the following conclusions are made:

1. The accidental deaths by flame burns are a common scenario in young females as substances like kerosene and cooking gas are easily accessible at home. These accidental burns are preventable by adequate safety measures and safety education.
2. Deaths due to burns are more common in married women, which could be mainly due to indulging themselves in household works majorly in cooking. The never ending harassment and torture by husband and in-laws for dowry also contributes to the increased deaths among married women. In many cases of dowry deaths, the history may be false.
3. Various factors like young age at the time of marriage combined with inability to cope with the physical and psychological stress of marriage, harassment from in-laws, failures in life are blamed for suicidal burns.
5. Socio-economic factors like use of fire woods for cooking in rural areas, huts with thatched roofs, inadequate precautions during cooking and wearing of cloths made of polyester/sarees contribute to the high rate of accidental flame burns.
6. Since scald injuries in children are very common, mothers and care takers should always take precautionary measures while handling their infants and toddlers.
7 Most of the burn victims in our study survived for 3-5 days (34 %), and this is attributed to the intra venous fluids administered, antibiotics given and supportive management in the burns Centre.
8. Major cause of death in burn victims is septicemia as superadded infections are common in them due to their depressed immune mechanisms and loss of protective layer of the body.
9. Usually victims of burns die due to hypovolemic shock, toxemia or septicemia. But in many cases it may not be possible to assess the actual cause of death from autopsy findings only. In these situations, depending on the duration of survival of the victim the changes that are noticed on histopathological examination of various vital organs like lungs, liver and kidneys will help in determining the final cause of death.
10. In our study majority of lung specimens showed diffuse alveolar damage as the major histopathological change which is due to the inhalation of incomplete products of combustion (inhalational injury) and septicemia.
11. The liver showed changes of hepatic necrosis, cloudy swelling, fatty changes but they cannot be the sole causes of death in burn victims.
12. The kidneys showed acute tubular necrosis (ATN/AKI) in majority of specimens which is a common pathology behind acute renal failure in burns patients. Acute renal failure is a well-known complication and dreadful consequence of burns as it may lead to an increase in mortality about 80% as proved by many studies. Assessment of renal function in burns cases should start from day of admission including glomerular and tubular function tests. This helps in early detection of acute renal failure and dealing with those patients in order to improve their outcome.

Ethical Clearance: Obtained
Conflict of Interest: None
Financial Assistance: None

References:

1. Ghaffar UB, Husain M, Rizvi J S. Thermal burns: An epidemiological prospective study. J Indian Acad Forensic Med 30(1): 10-4.
2. Reddy KSN. The essentials of forensic medicine & toxicology. 29th ed. Suguna Devi publications. Hyderabad: 2010. 280-288.

3. Chawla R, Chanana A, Rai H, Aggarwal AD, Singh H, Sharma G. Clinico-Pathological Profile in Deaths Due to Burns. Internet Journal of Indian Academy of Forensic Medicine. 2011: 33(1): 14-17.
4. Dasari Harish, Kumar A, Sharma BR. Burns septicemia- the leading cause of burn mortality. JPAFMT. 2008: 8(2): 10-14.
5. Cakir B, Yegen BC. Systemic Responses to Burn Injury. Turk J Med Sci. 2004: 34; 215-226.
6. Taylor FW, Gumbert JL. Cause of Death from Burns: Role of Respiratory Damage. Annals of surgery. April 1965: 161(4): 497-501.
7. Wróblewski P, Knefel G, Trzaska M, Kawecki M, Nowak M, Kozielski J. Respiratory tract burn injuries. Pneumolog allergol pol. 2011: 79(4): 298-304.
8. Toor AH, Tomashefski JF Jr, Kleinerman J. Respiratory tract pathology in patients with severe burns. Hum Pathol. 1990; Dec: 21(12):1212-1220.
9. Ravelo V. Argamaso. Pathology, Mortality and Prognosis of Burns: A Review of 54 Critical and Fatal Gases. Canad. Med. Ass. J. Aug. 26, 1967: vol. 97: 445-449.
10. Shinde AB., Keoliya AN. Study of Burn Deaths with Special Reference to histopathology in India, Indian Journal of Basic & Applied Medical Research; September 2013; 8(2):1153-1159.
11. Jeschke MG. The Hepatic Acute Phase Response to Thermal Injury Burns. Mol Med. 2009 Sep-Oct: 15(9-10): 337–351.
12. James G. Watson III, Purnell OJ,Evans E I. The anemia of thermal injury: I. Studies of pigment excretion. J. Clin. Invest. 1951: 30: 181-184.
13. Lars HE, Bhavsar D and Mailander P. The biology of burn injury: Experimental Dermatology. John Wiley & Sons A/S. March 2010; 19: 777–783.
14. Sevitt S. Distal tubular and proximal tubular necrosis in the kidneys of burned patients. Clinical journal of Pathology. 1956; 9 (4): 279-294.
15. Yan SN. et al. Patho-morphological study of the kidneys and its relationship to renal dysfunction in 24 burned patients. Paper presented at Symposion on Burns; the 7th Military Medical College; Chongqing. 1960: 136-142.
16. Cernea D, Bold A, Mateescu GO, Simionescu C Microscopic assays regarding the renal damage following a post-combustional shock. Romanian Journal of Morphology and Embryology. 2005: 46(4): 291–294.
17. Palmieri T, Lavrentieva A, Greenhalgh DG. Acute kidney injury in critically ill burn patients, Risk factors, progression and impact on mortality. J of burns. 2010 Mar: 36(2): 205-211.
18. Coca SG, Bauling P, Schifftner T, Howard CS, Teitelbaum I, Parikh CR. Contribution of acute kidney injury toward morbidity and mortality in burns: a contemporary analysis.Am J Kidney Dis 2007;49(4):517-23.
19. Steinvall I, Bak Z, Sjoberg F. Acute kidney injury is common, parallels organ dysfunction or failure, and carries appreciable mortality in patients with major burns: a prospective exploratory cohort study. Crit Care. 2008; 12: 124-129.