OCCURRENCE AND EARLY OUTCOMES OF INHALATION BURNS IN BURN INJURY PATIENTS ADMITTED TO KENYATTA NATIONAL HOSPITAL; A REFERRAL BURNS CENTRE IN EAST AFRICA

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2007

DECLARATION

I hereby declare that this dissertation is my original work and has not been submitted for the award of any degree in any other university.

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ABBREVIATIONS

ABSI- Abbreviated Burn Score Index

BMJ-British Medical Journal

BJS-British Journal of Surgery

BU-Burns Unit

CVP-Central Venous Pressure

Fi02- Fraction concentration of inspired oxygen

HDU-High Dependency Unit

H.I.V. - Human Immunodeficiency Virus.

ICU- Intensive Care Unit

KNH- Kenyatta National Hospital

MAP-Mean Arterial Pressure

NEJM-New England Journal of Medicine

OFR-Oxygen Free Radicals

$PaC0_2$ -Alveolar (arterial) carbon dioxide pressure

$Pa0_2$ - (Fj02)(PB - PH_20) - ($PaC0_2$/RQ)

$Pa0_2$- Partial pressure of oxygen in the alveolus

PAWP-Pulmonary Arterial Capillary Wedge Pressure

PBH-Post Burn Hour

PB- Barometric Pressure

PH_20- Partial pressure of water vapor (47 mmHg at body temperature, ambient pressure)

RQ - Respiratory Quotient (estimated at 0.8)

TBSA-Total Burn Surface Area

SUMMARY

Introduction; Burn injuries occur universally and have plagued mankind from antiquity till now. Burn injuries constitute a major cause of morbidity and mortality worldwide. Inhalation burns occur in most of severe cases resulting in the immediate post burn deaths if appropriate measures are not undertaken.

Methods; This was a descriptive cross sectional prospective study carried out over a period of 4 months among severely burnt inpatients at Kenyatta National Hospital in Bums Unit, Intensive Care Unit(ICU) and High Dependency Unit(HDU) who met the inclusion criteria.

Results; A total of 50 patients with a mean age of 23 years were enrolled. The male to female ratio was 3:2 with almost all of the patients being of low socioeconomic status. Over 80% of the patients were from house fires. The mean time before admission was 4 hours. Sixteen patients were intubated and 31 % of these died within the first 72 hours of admission.

Conclusion; Most inhalation burn injuries occurred due to house fires. Intubation was done without bronchoscopy. There is need for fire prevention policy and adherence to inhalation injury management protocol.

INTRODUCTION

Bums are a major cause of morbidity and mortality at the Kenyatta National Hospital (KNH).[1] Patients with severe burn injuries which includes inhalation burns are admitted to Burns Unit (BU) High Dependency Unit (HDU) or Intensive Care Unit (ICU). There are more incidences of burns occurring in closed spaces, schools, hostels and factories. With the available prehospital service the early presentation of these patients to the burns unit and appropriate care especially timely securing of an airway is necessary for improved outcomes. The resuscitation of major burns injury involves the administration of large volumes of fluids calculated on the basis of Percent TBSA, body weight and adjusted accordingly to monitored clinical indices. Until the end of nineteenth century, there was no emphasis on changes in body physiology after bum injury. It was shown that 50-75% of the deaths in bums occurred in the first 48 hours. Improvement in the knowledge of surgical physiology and initial plans for disaster care were made.[2]

Patient resuscitation should be adapted to individual patient's characteristics that is age, percent TBSA, presence or absence of inhalation injuries, pre-morbid conditions and delayed fluid resuscitation. No single monitor of perfusion in the bum patient can be considered to be a completely reliable indicator of tissue oxygenation and therefore several standard haemodynamic monitors and laboratory tests are utilized.[3]

Continuous research is encouraged in this important area, which determines survival in major bums. Mortalities as high as 68% have been recorded in bum patients with associated inhalation injury.[1] In KNH, no study had been done specifically to assess inhalation bums, management and outcomes hence this study which aimed to generate useful data to improve the management of these patients.

LITERATURE REVIEW

THE PATHOPHYSIOLOGY OF INHALATION INJURY

Inhalation injury has been the main factor responsible for mortality in burn patients. While reports have shown little progress in reducing the mortality associated with inhalation injury, some have noted significant progress. Better understanding of the pathophysiology will improve treatment.[2]

Known risk factors for bums including extremes of age, diabetes mellitus, blindness, epilepsy, psychiatric illness, alcohol intake and smoking are universal with variations observer in different socioeconomic settings.[2]

Inhalation burn injury results from dissipated heat in inspired hot gases and substances (thermal damage), effects of gases and toxic byproducts of combustion (including carbon monoxide) and the effect of burn on the face as well as upper airway. Approximately 80% of fire related deaths from inhalation of the toxic products of combustion. Blinding and irritating effects of smoke as well as the decreasing oxygen concentration that occurs with combustion resulting in progressive hypoxia may potentiate incapacitation of potential victims. It is imperative to know the source of the fire and the combustion products generated when treating a fire victim.[2,3]

Alveolar gas equation can be used to estimate the efficiency of pulmonary oxygen delivery to the arterial circulation. It is a formula that determines alveolar oxygen pressure. The difference between the partial pressure of oxygen in the alveolus and that measured on an arterial blood gas is the alveolar-arterial (A-a) gradient. Values usually less than 5-10 mm Hg may be several hundred mmHg in the setting of significant pulmonary injury and can be used to assess improvement or deterioration in lung function when measured at a stable $F,0_2$. $Pa0_2 = (Fj0_2)(PB - PH_20) - (PaC0_2/RQ)$

$Pa0_2$ = Partial pressure of oxygen in the alveolus

$Fj0_2$ = Fraction of inspired oxygen

PB = Barometric pressure

PH_20 = Partial pressure of water vapor (47 mm Hg at body temperature, ambient pressure)

$PaC0_2$ = Alveolar (arterial) carbon dioxide pressure

RQ = Respiratory quotient (estimated at 0.8)

Symptoms vary with carboxyhemoglobin levels, but correlation between carboxyhemoglobin levels and eventual neurologic outcome is poor.[3]

Forccs responsible for the variables of the Starling-Landis equation;

Filtration rate at any point along a capillary depends upon a balance of forces commonly named the starling forces after the physiologist who first described their operation in detail. One of these forces is hydrostatic pressure gradient (the hydrostatic pressure in the capillary minus the hydrostatic pressure of the interstitial fluid) at that point.[4] Interstitial fluid pressure varies from one organ to another. It is positive in the liver and kidneys and is as high as 6mmHg in the brain. The other force is the osmotic pressure gradient across the capillary wall (colloid osmotic pressure of plasma minus colloid osmotic pressure of the interstitial fluid).[4]

This component is directed in one word.

Thus

Fluid movement= k [(P_c+7ii) - (Pi + tc)]

Where

k = capillary filtration coefficient

P_c= capillary hydrostatic pressure

Pi= interstitial hydrostatic pressure

JXc = capillary colloid osmotic pressure

7ij = interstitial colloid osmotic pressure [4]

Damage seen in the oropharynx following inhalation injury is the same as that seen in thermal injury in other areas of the body. Heat denatures proteins that in turn activate complement. Complement activation causes the release of histamine. During this conversion oxygen free radicals are released. Oxygen free radicals cause edema formation through increasing permeability to protein and increasing the microvasular pressure. Attraction of polymorphonuclear cells then amplifies the release of oxygen radicals, proteases and other materials into burnt areas. [2,3]

Massive oedema accruing in the soft tissue of the oropharynx following burns involves most of the variables in the Starling equation. There is a large increase in microvasular hydrostatic pressure, a decrease in interstitial hydrostatic pressure, a fall in the filtration coefficient and an increase in interstitial oncotic pressure. Resultant oedema if severe may obstruct the airway, not only making it difficult to breathe but also making it difficult for the anesthesiologist to intubate the patient.[2]

To avoid this problem many units prophylactically intubate patients who have evidence of thermal injury to the upper airway on admission. However intubation in itself may present problems including trauma to the larynx. The flow chart below illustrates this pathophysiology.

FIGURE 1 Illustrating the mechanism for oedema formation in the oropharynx.

Complement activation

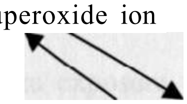
1

Histamine release

1

Conversion of xanthine oxidase

Release of superoxide ion



Permeability changes Neutrophil adherence

Victims of fire accidents especially those who are injured in enclosed areas, sustain chemical injury to their respiratory tract as a result of breathing toxic gases associated with the incomplete combustion of the burning materials, especially acrolein and formaldehyde.[3] Actual thermal injury to the airway is rare. The heat capacity of air is low and the upper airway is very efficient at warming and cooling gases.[2] Consequently flames must almost come into direct contact with the airway to induce injury. There are some instances in which hot particles might be inhaled. There are also reports of individuals with steam inhalation. In these cases, there is direct thermal injury to the bronchi and trachea.[2]

With chemical damage to the airway, there are two almost instantaneous happenings: ciliated epithelial cells separate from the basement membrane and there is an almost immediate dilation of the systematic circulation to the lung and the bronchial circulation. These latter changes appear mainly in the mucosal areas and can be detected by laser Doppler technique. Soon after this has occurred edema can be visually detected in the trachea. Oedema is also evident histologically and by gravimetric techniques. The oedema is associated with vascular permeability to larger molecular weight substances. Rapid occurrence of these changes to the airway and their universal presence after some insufflations into the bronchial areas should make it relatively easy to diagnose inhalation injury by bronchoscopy. The degree of increased airway blood flow does not appear to be related to the extent of smoke exposure. Rather the dilation appears to be an all-or-nothing phenomenon. Longer duration of exposure appears to correlate with more areas of the airway showing greater increases in blood flow.[3]

Early inflammatory changes that occur in the airway are followed by a period of diffuse exudate formation. Protein composition of this material suggests that it is an ultrafiltratc of the lung lymph. This transudate can induce a bronchoconstriction. It contains thromboxane (TX) B; the stable metabolite of a potent smooth muscle constrictor. Unlike other forms of airway inflammatory disease inhalation injury also demonstrates narrowing of the large airways. Mucosa of the airway can hold a large amount of edema, which can produce marked narrowing of the airway.[2, 3]

Major burns precipitate a systemic inflammatory response that if overly prolonged or exaggerated can lead to organ dysfunction, sepsis, or both. Local mediators appear within minutes to hours after the injury. Among the systemic mediators, plasma levels of interleukin-1, 2, and 8 are elevated very early. Increases in the level of interleukin-6 occur with sepsis. Transient elevations of tumor necrosis factor are associated with a poor prognosis. Interferon-levels tend to peak about 10 days after the burn. Many factors in addition to the extent of the burn, especially age, determine the severity of injury. A burn involving 20 percent of the body-surface area involves a 30 percent risk of mortality in a 70-year-old patient but is not lethal in a 20-year-old patient.[2]

The exudative materials coalesce with time to form fibrin casts which induce complete occlusion of the airway. Following destruction of the epithelium and the presence of these airway casts, which function as culture media, there is a greater susceptibility to infection, leading to pneumonia, sepsis and death. During the recovery period, there is first the formation of pseudomembrane in the airways. This is followed by a squamous cell metaplasia. Healing may take place as late as 18 days after injury. The burn or the therapy can cause permanent airway damage, including airway stenosis and granuloma scar formation of the trachea.[2]

Carbon monoxide toxicity

Carbon monoxide toxicity (CO) is a common cause of death in smoke-induced inhalation injury and must be suspected in fire victims and treated promptly. Inhalation of 0.1% CO mixture may result in generation of carbon hemoglobin level as high as 50%.

Carbon monoxide has an affinity for hemoglobin that is 200-250 times that of oxygen and readily leads to anoxia and death. The oxygen-hemoglobin dissociation curve losses it's sigmoid shape and is shifted to the left, impairing tissue oxygen availability. Competitive inhibition with cytochrome oxidase enzyme systems results in an inability of cellular systems to utilize oxygen. Lower concentration of CO may also impair decision-making and psychomotor responses.[2,3,4]

Hydrogen Cyanide and other degradation products

Other degradation products namely aldehydes, hydrogen cyanide, hydrogen chloride produced from polyvinyl chloride degradation and nitrogen oxide may also contribute substantially to the morbidity and mortality in a burn victim.[3]

Symptoms and Signs

Toxic symptoms become manifest at levels greater than 20% and death may occur at levels greater than 60%. Table 1 shows toxins and their sources. Table 2 shows symptoms and signs of carbon monoxide poisoning.

Tabic 1: Origin of selected toxic compounds other than CO or $C0_2$ during burn injury.

MATERIAL	**SOURCE**	**DECOMPOSITION PRODUCTS**
Cellulose	Wood, paper, cotton, jute	Aldehydes, acrolein
Wool, silk	Clothing, fabric, blankets, furniture	Hydrogen cyanide, ammonia, hydrogen sulfide
Rubber	Tires	Sulphur dioxide, hydrogen sulfide
PVC	Upholstery, wire/pipe coating, wall, floor, furniture covering	Hydrogen chloride, phosgene
Polyurethane	Insulation, upholstery material	Hydrogen cyanide, isocyanates, ammonia, acrylonitriles
Polyester	Clothing, fabric	Hydrogen chloride
Polypropylene	Upholstery, carpeting	Acrolein
Polycrylonitrile	Appliances, engineering plastics	Hydrogen cyanide
Polyamide	Carpeting, clothing	Hydrogen cyanide, ammonia
Melamine	Household goods	Hydrogen cyanide, ammonia,
Acrylics	Aircraft windows, textile, wall coverings	Acrolein

Tabic 2: Symptoms and signs at various concentrations of carboxyl hemoglobin

CO-**Hb%**	**Signs and symptoms**
0-10	None
10-20	Mild headache, atypical dyspnea
20-30	Throbbing headache, impaired concentration
30-40	Severe headache, impaired thinking
40-50	Confusion, lethargy, syncope
50-60	Respiratory failure, seizures
>70	Coma, rapidly fatal

HISTORICAL BACKGROUND IN BURNS MANAGEMENT

According to a book review by James Partridge, he notes that Klasen explains with extensive references that date back to 1500BC when boiled goat excrement, herbs, and onions were the recommended treatments and how burn care has emerged as a speciality. The first burn hospital was created in August 1843 when a cottage on the grounds of Edinburgh Royal Infirmary was dedicated to men and women with severe bums. Later it was discovered that this was established only because the surgeons wanted the stinking the stinking burn patients out of their wards. Advances have led to studies on various injuries and implications of intervention at molecular level.[5]

Inhalation injury significantly increases mortality of burned patients compared to other injuries by up to 68% versus 8% as found out by Nthumba.[6] In a study of 56 patients by Babatunde Osinaike et al in Nigeria in 1999-2003 inhalation injury constituted 35% of under 5 year old patients admitted to ICU. Endotracheal intubation was associated with poor outcome with mortality of 46%. It was also found mortality correlated with level of pre hospital care which in developing world is under funded. It is useful to characterize patterns of injury to formulate planning programmes targeted at preventing childhood injuries.[7]

Oluwatosin concurred that there are no functional rescue teams in Nigeria and basic things like bronchoscopy and IV Xenon scans are not available in most units in Africa. He noted that in the absence of sepsis HIV patients have same length of hospital stay, same need for skin grafting and graft take as non-HIV patients. Burn prevention strategies are needed all over Africa especially in use of petroleum products.[8]

South Africa is the only country with a Petroleum Safety Association to promote safety in domestic use of paraffin. The association influences policy, surveillance, community involvement, environmental interventions, reorientating services and health advice. It also incorporates the media and disaster management training. In a study of fire preventive devices in Nigeria following the increased incidences of victims trapped in burning buildings Olaitan recommended collapsible burglar proof. [9]

In a retrospective study in South Africa Whitelock et al advised early diagnosis and appropriate management.[10]

Fires in the developed world unlike the rest mostly occurred in mass gatherings (sports venue, night clubs, cinema halls, theatres, shopping malls, hotels, hostels, industrial complexes and mines).[11, 12] House fires remain an important cause of death and injury. Interventions programs to prevent injuries related to house fires are most efficient when directed to the groups at highest risk. The increased rates of injury from house fires among blacks, the elderly, and those living in low income areas of Dallas is consistent with the results of other studies. However, the magnitude of the difference that were found between the lowest and highest incomes, which was greater than a factor of 20, was surprising.[13]

The incidence of bum injury has declined over the past several decades in the United States and in some developed countries. In-hospital fatality rates have declined and are now only about 4 percent among patients with major injuries who are treated in specialized burn units. This cannot be stated so for the developing world.

In an effort to reduce Fire Costs by monitoring progress on safety measures as is done with road safety, crime prevention and industrial safety, the European Parliament called on the European Commission to establish a Working Party of fire experts whose terms of reference would be to recommend ways of tackling the fire problem.[14] Cigarettes are a major cause of residential fires. One potential solution is the development and sale of "fire-safe" cigarettes, which fail to ignite household furnishings on contact.[2]

Ashraf in Alexandria found predominance in children and females in Egypt noting a relationship between age (87% below 40 years), gender, socioeconomic status (67% not working) development, behaviour and occurrence of burns. [12]

Ashish and his colleagues in India found the majority of burns were accidental, seen in middle-aged housewives as a result of flame bums, and led to death. He suggested measures should be taken to provide proper education to prevent these accidents and ensure safety.[12]

Politics, distance, language, ongoing security concerns become compounding factors in an already difficult equation of victim triage, retrieval, emergency management and dispersal as witnessed at the American embassy bombings in Nairobi.[1, 12, 15,16]

In an incident in North Carolina patients were received 15 minutes after an air crash. As a result of repetitive drills each year, the triage area and emergency department were cleared of all patients within 2 hours. Fifty patients were transferred to burn centers, including 43 patients to the US Army Institute of Surgical Research. All patients survived. A similar crash and fire occurred outside of Fayetteville, North Carolina. With heightened interest in the need for planning for future mass-casualty events, the experience and lessons learned by the referring and receiving hospitals are noteworthy. The burn patient not expected to survive who is kept at the referring hospital during a disaster consumes enormous resources. Transfer of the mortally injured burn patient to a burn center frees up these resources at the referring hospital, which still has a sizable group of burned patients, including outpatients, to manage. Several factors contribute to the success in the initial management of the disaster.

The nonsurgical physicians called to augment this role need to be trained in Advanced Bum Life Support and Advanced Trauma Life Support.[15,16,17]

The Centre for Disease Control and Prevention (CDC) includes inhalation injury among blast injuries.[18]

Quaternary blast injuries encompass exacerbations or complications of preexisting conditions as might occur in pregnant women and patients receiving anticoagulants can present with respiratory compromise. Burns and other quaternary injuries were an important outcome of the attack on the Pentagon on September 11, 2001, in which terrorists used a fuel-laden aircraft.[1]

In Philadelphia about 6% of bum center admissions do not survive. Since 1965, bums of 10% TBSA or less has doubled, from 26% to 54%, while large burns (60% TBSA or greater) have declined from 10% to less than 4% of total admissions.

This trend reflects both an absolute decline in large burn injuries and increased specialized facilities and experience in treating bum injuries.[19]

The management of the burn injuries is a complex process needing repetitive admissions including ICU and psychiatric support.[20,21]

Historical records shows lack of attention to the respiratory status of the victims cost

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many lives.

Firefighters reported cough dubbed World Trade Center cough. The disability related to respiratory exposures on and after September 11 provides important lessons for civil defense. Disasters of a similar scale are possible in the future and require containment protocols.[19]

In a mass burn accident many patients require intubation, tracheostomy, bedside bronchoscopy for diagnosis and therapeutic pulmonary toilet. When the sequelae of inhalation injury become manifest and the need for many surgical procedures critical, postoperative mobilization instruction, standard ventilation protocols, sedation protocols for intubated patients and donor site care plans are helpful. Harrington et al suggested this would be ideal to enroll in clinical trials as was done at the US Army Institute of Surgical Research in 1993. This allowed for the enrollment of large numbers of patients in clinical trials ranging from the ongoing 5% Sulfamylon trial to a new protocol investigating [OMEGA]-3 fatty acids.[23] Magnesium dust contributes to the clinical condition and require admission as inhalation injury is one of the criteria for admission to a bum center according to The American Bum Association which is widely used..[24,25]

Diagnosis

The diagnosis of inhalation injury is primarily clinical. Chest radiograph findings are routinely normal until complications develop. Bronchoscopy findings may include carbonaceous debris, ulceration, or erythema. Bronchoscopy is useful in cases where the decision to perform endotracheal intubation is unclear. Serial bronchoscopy removes debris and necrotic cells in aggressive pulmonary toilet when suctioning and positive pressure ventilation is insufficient.[2-3]

To monitor oxygen saturation, recognizing that CO falsely elevates cutaneous pulse oximetry is imperative. CO oximetry uses a 4-wavelength technique of light refractance to measure carboxyhemoglobin and oxyhemoglobin, in addition to deoxyhemoglobin and methemoglobin. The percent oxyhemoglobin measured by CO oximetry is an accurate measure of the arterial oxygen saturation.[3]

Arterial blood gas measurements assess the adequacy of pulmonary gas exchange. The presence of low Pa02 (<60 mm Hg in room air) or hypercarbia (PaC02 >55 mm Hg) is indicative of significant respiratory insufficiency."

Medical Therapy

A high index of suspicion and a thorough knowledge of the appropriate management of the smoke inhalation victim is essential in assuring a good prognosis.[1]

The most important aspect of management involves prompt removal of victims from the fire site to minimize further exposure to combustion products which render them unable to escape. Prompt administration of oxygen, maintenance of airway, breathing and circulation and rapid hospitalization are then of paramount importance.

Patients are evaluated for the extent of disease. Patients with signs of airway obstruction, bronchospasm, respiratory distress, or concurrent burns are admitted to the hospital for appropriate monitoring since edema and obstruction typically worsen over the next 24-48 hours.

Airway patency and stability is ensured. Direct laryngoscopy and fiber optic endoscopy are useful to evaluate the extent of airway edema and bums. Elective intubation should be considered because progression of oedema makes later intubation difficult.

Patient responsiveness determines ability to protect the airway and indicates adequacy of resuscitation success. The neurologic examination is frequently clouded by hypoxic and toxic neurologic injury and the necessary use of potent analgesics.

A course of corticosteroids is attractive for suppressing inflammation and reducing edema but prolonged use of steroids causes infection and delayed wound healing Discerning secondary infection can be difficult because both may produce fever, elevated white blood cell counts, and radiographic abnormalities.

All fire victims should commence 100% oxygen while on transit to hospital. Loss of consciousness, cyanosis or an inability to maintain the airway requires endotracheal intubation, which will allow delivery of 100% oxygen to the patient, may be necessary. Hyperbaric oxygen therapy may be necessary if the COHb level exceeds 25% or if significant clinical toxicity is present. Survivors may demonstrate a 'pseudorecovery' associated with neurological or mental deterioration some months after an initial recovery. Hyperbaric oxygen may reduce these neurological features.[3,4,26,27,28-29]

A distinctive odour of bitter almonds may initially arouse suspicion of cyanide toxicity in fire victim. Symptoms of hydrogen cyanide toxicity may progress rapidly, and include lethargy, nausea, headache, weakness, coma and acute electrocardiograph S-T segment elevation, which may mimic an acute myocardial infarction. Suitable treatment at the fire site involves intravenous administration of sodium thiosulphate and hydroxycobalamin (4g). 100% oxygen should also be given.[3]

Utility of chest physiotherapy is widely accepted but remains unproven in controlled trials. Use of percutaneous cupping and postural drainage seem reasonable to clear airways of cellular debris and soot, thereby preventing atelectasis and obstruction. Bronchoscopy is helpful in removing the debris and in facilitating pulmonary toilet. With declining lung function, oxygenation, and ventilation, mechanical ventilation with positive end expiratory pressure (PEEP) may be necessary. Ideally, PEEP stents alveoli open. Vigorous pulmonary toilet, with toilet bronchoscopy in selected patients, is a very important component of therapy.

Timing of tracheostomy continues to be controversial. Tracheostomy has an increased complication rate and risk of sepsis when compared to endotracheal intubation. In patients expected to have a long period of convalescence tracheostomy may be desirable for patient comfort.[2] Tracheostomy in children is associated with a higher incidence of structural problems and is avoided whenever possible. •

Predicting Outcomes of Burns

According to Saffle, the chances of survival after burn injury have increased steadily during the past 50 years. At the end of World War II, only 50 percent of patients survived burns involving 40 percent of their total body-surface area. Today, over 50 percent of all patients with burns involving 80 percent of their total body-surface area survive, and the survival rate may be even higher for adolescents and young adults, among whom almost no burn is too extensive to preclude recovery. This remarkable success can be attributed to therapeutic developments, including vigorous fluid resuscitation, the early excision of bum wounds, advances in critical care and nutrition, powerful topical and systemic antibiotics, and the evolution of specialized, multidisciplinarybum centers.

Burn centers have concentrated on improving survival as a primary goal. Advanced age (more than 60 years), extensive burn injury (more than 40 percent of the body-surface area), and inhalation injury are the strongest predictors of death among patients with burns. As the treatment of bums has improved, the presence of inhalation injury has emerged as an increasingly important factor for many patients, who often die of pneumonia and subsequent multiple-organ failure. Recent developments in ventilator management and critical care may be associated with improved outcomes.

The advent of positive-pressure ventilation that is delivered through a nasal or facemask has greatly expanded the use of noninvasive ventilation. Many patients can avert the trauma and hazards of intubation and mechanical ventilation by using noninvasive ventilation. An expanded awareness of noninvasive ventilation devices and techniques promises to increase the therapeutic options for patients with severe respiratory insufficiency as found in inhalation injury patients.[27]

Immunocompromised patients with respiratory failure have profound poor prognoses, with mortality rates ranging from 60 to 100 percent, depending on the underlying diagnosis and factors such as age, functional status, the acute physiology and chronic health evaluation score, the presence or absence of multi-organ failure, and the duration of neutropenia. Recent studies indicate that the use of noninvasive ventilation can reduce the need for intubation and lower the mortality rate and can be used in immunocompromised patients. Given the risks of serious complications and death associated with intubation, appropriately applied noninvasive ventilation should change the approach to ventilation in immunocompromised patients with respiratory failure.

Only patients who are severely ill or who have no response to noninvasive ventilation should undergo intubation.[JO]

The prevention of deaths from fires is based on preventing asphyxiation from smoke inhalation, since three quarters of deaths due to residential fires occur at the scene and are caused by smoke inhalation. Smoke detectors have been shown to reduce the risk of death by approximately 70 percent. Community-wide programs to increase the use of smoke detectors have resulted in an 80 % decrease in mortality and a 74 % decrease in injuries from residential fires. Legislation although virtually unenforceable, does increase the proportion of homes with working detectors decreasing fire related deaths. Sprinkler systems have been proposed as a means of preventing fires."

Reccnt advances in inhalation burn treatment

These include extracorporeal membrane oxygenation, nitric oxide and permissive hypercapnia but no randomized tnals yet been performed. Inhalation injury remains an important cause of death in patients with bums.

In one large cohort the mortality rate was 29 percent when inhalation injury was present and only 2 percent in its absence.[,0]

Pediatric patients with acute burns often require many operative procedures in short succession, yet due to inhalation injury or recent extubation their airways may be susceptible to tracheal tube induced damage. Hillberg and Johnson proposed the laryngeal mask airway (LMA) as a useful airway management tool. The series and others demonstrated the LMA was a safe and efficacious airway management device in the pediatric burn population.[20-31]

Effect of body positioning on oxygenation is often not appreciated amid the causes and interventions for hypoxaemia.[32] Additionally, routine positioning of immobile patients may cause hypoxaemia and hypotension with patients suffering from head injuries and/or strokes being particularly vulnerable to damage from mild hypoxaemia and hypotension.[33]

Patients on oxygen are subject to complications caused by the oxygen itself. Use of positive end-expiratory pressure (PEEP) can further aggravate hypoxaemia.[32, 34, 35] Appropriate positioning of the critically ill patient can dramatically improve gas exchange. This may improve outcome for the critically ill patient and avert the admission to the critical care unit.[ft] Prone position aids pulmonary secretions to be mobilized and drained improving ventilation. Use of patient positioning appears to improve oxygenation in patients with acute lung injury and respiratory distress.

Pain control reduces the exacerbating adverse physiological effects of burn injury in addition to humanitarian benefits of appropriate pain control in burn survivor.[3*]

In natural disasters potential exists for trauma from structural damage, burns and smoke inhalation from fires. Falls and electrocution from electrical lines are all real. In the case of a hospital. X-ray equipment, crash carts, monitors, ventilators, air conditioning, gases, water, elevators, etc. may pose a threat to patients and staff. In earthquake-prone areas, the need to make the workplace safer is a high priority.[34]

RATIONALE FOR THE STUDY

Burns are a common and serious cause of injury in our locality. Severe burns are associated with very high mortality as reported in Kenyan studies.[1, 6] A significant number of these deaths occur in the acute phase in inhalation injury patients. This is in contrast to experience in many specialized burn centres where mortality rate averages 4% in many series. There does not seem to be overall decline in incidence and severity of burns as reported elsewhere.[2, 40, 41]

Buni in 2006 found 12.6% of 200 burn patients at KNH to have inhalation burns.[40] Only 6 of 46 adult patients with severe bums (BSA 30% tol 10%, mean 52.3%) followed up by Mogire in a study done in 2004 in KNH survived, with 20 dying within one week. Inhalation injury may have contributed to this high mortality.[1]

There were no local studies specifically on inhalation injury in burn patients. This study aimed to yield more information on the management and outcome of patients with inhalation injury.

STUDY OBJECTIVES

Broad Objective

To determine the pattern of presentation and management strategies of inhalation bum injury as seen at Kenyatta National Hospital.

Specific Objectives

1. To determine the prevalence and risk factors for inhalation burn injury.
2. To determine the need for intubation and tracheostomy
3. To determine the early management outcomes.

METHODOLOGY

Study design

This was a hospital based descriptive prospective study between 16th July 2007 and 15^{lh} November 2007.

Study Area/Population

This study was carried out at Kenyatta National Hospital accident and emergency department (casualty), burns unit, intensive care unit and high dependency unit.

Inclusion Criteria

1. All patients admitted to K.N.H. with inhalation bums over the study period that consented to the study.

2. All types of inhalation injuries.

Exclusion criteria

1. All patients with other burns not otherwise eligible in the study.
2. Those patients who did not consent to be recruited into the study.
3. Patients treated as outpatients.

Methodology

Inhalation injury was defined as any burn due to fire in an enclosed space and/or burns to the face or oropharynx or larynx. Patients were consecutively recruited from among severe burn patients in the Casualty Resuscitation Room, 1CU, HDU and Burns Unit within 24 hours of admission.

Data for those for whom consent was obtained was collected on a questionnaire. The time of bum was considered as time zero so the 72 hours period of early management was calculated from time of admission. Each patient status was reviewed and documented at 24 hours and 72 hours post admission. Registration data; age, sex, residence, marital status, level of education and occupation were entered on the questionnaire. The setting of the burn injury whether accidental or intentional was documented. Cause of burn was recorded under the individual categories of liquids, flame and chemical burns.

Time of burn was documented as the time the burn occurred according to the history available. Time interval from burn to admission was calculated. Recorded indicators other than the demographic data included duration before admission, the unit of admission whether ICU, HDU or Burns Unit, duration before admission, duration before intubation, bronchoscopy examination details, blood gas analysis, patient status at admission, at 24 hours post admission and at 72 hours post admission.

Comorbid conditions and known risk factors for burns, such as diabetes, blindness, epilepsy, psychiatric illnesses, smoking and alcohol intake were entered as coded on the questionnaire. Each of the indicators specific for inhalation burn injury noted in each patient was recorded.

Each patient with inhalation burn injury upon diagnosis was classified in terms of severity. Patients with no respiratory distress were considered stable. Patients developing respiratory distress in the first 24 hours of admission were considered unstable. Patients in respiratory distress at admission were considered to be in distress at arrival. Patients dying within 24 hours of burns injuries involving the respiratory system were considered as dead. The interventions performed including bronchoscopy and intubation were recorded, as was the time in hours that this was carried out post-admission.

All investigations performed, resultant interventions as well as the status with regards to the patient were reviewed by the investigator every morning and documented. Any result or procedure requiring a change in patient management was pointed out to the attending doctor. These included bronchoscopy findings at intubation, chest radiograph findings, arterial blood gas analysis, electrolytes, and haemoglobin levels.

A copy of the questionnaire used is attached as appendix 1.

Sample Size Determination

There was no previous study on early management outcomes of inhalation burn injuries at KNH. 1 used a study done in Nigeria by Ugburo [41] to get the prevalence of intubated patients in an inhalation burn population.

Given a confidence interval of 95% and a level of precision of 5%, the below formula was used during this study for sample size determination.

$$N = 4Z \propto^2 \times \frac{n(1-p)}{w^2}$$

N = sample size to be determined

p = estimated prevalence of intubated inhalation burns patients.

Z = standard errors of the mean corresponding to 95% confidence interval (0.05)

$\propto$ =1.96

w = Absolute precision (0.05)

Intubated patients constituted 17 % of inhalation burn patients in a Nigerian study [42]. Using the above formula this translates to a sample size of 43 patients.

On average the Bums Unit admits 200 patients per year as shown in recent hospital admissions in the table below.

With the study period intended to be four months, a sample size of 50 patients was therefore considered reasonable.

KENYATTA NATIONAL HOSPITAL
<u>IN-PATIENT STATISITICS - 2000-</u>
2006

	2000	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**
G/Surgery Level 4 & 5	8979	9373	9228	10217	9132	8924	9256
Orthopaedic Level 6	4309	4521	4507	4955	4340	4123	4452
Burns unit	**194**	**167**	**196**	**197**	**201**	**221**	**242**
9D	700	761	659	769	604	522	572
HDU	**621**	**732**	**568**	**526**	**571**	**501**	**480**
ICU	**671**	**652**	**684**	**681**	**707**	**818**	**643**
Casualty Recovery	796	819	835	0	0	0	0
TOTAL	**16270**	**17025**	**16677**	**17345**	**15555**	**15109**	**15645**

Prepared by: Medical Records Department

5/2/2007

Sampling procedure

Consecutive sampling of patients who met inclusion criteria was used until the calculated sample size was achieved.

Data Analysis

Data was computer analysed using Software Package for Statistical Solutions (SPSS) version 13.0. Descriptive statistics such as means, frequency distribution and standard deviation were obtained for different parameters. Fishers exact test, chi-square and student t-test were used to determine associations between categorial variables a pbvalue < 0.05 being considered significant.

FUNDING SOURCE

The funds for this research were by myself.

ETHICAL CONSIDERATIONS

1) The study protocol was submitted to the Kenyatta National Hospital Ethical and Research Committee and approval was given in July 2007(See approval attached letter).

2) Informed written consent was obtained from patients or guardians before enrolment in the study.

3) Universal precautions were strictly observed while handling patients.

4) All patient information obtained remained confidential

DISSEMINATION OF RESULTS

Results of this study will be availed to the Department of Surgery, University of Nairobi Medical School Library and KNH Library.

RESULTS

A total of 50 patients were enrolled into the study. Two patients were admitted to the Intensive Care Unit. The rest were admitted to Burns Unit.

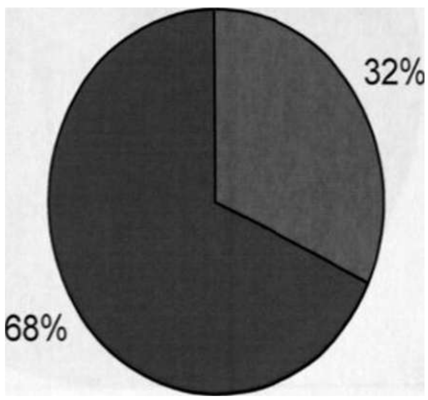
TABLE 3: Comparison of patient variables.

		Number of Patients	%
Total Patients		50	100
Age	0-10 yrs	13	26
	11-20 yrs	7	14
	21-30 yrs	14	28
	31-40 yrs	8	16
	41+ yrs	7	14
Sex	Male	29	58
	Female	21	42
Place of burn	Home	42	84
	Other	8	16
Circumstances	Accidental	43	86
	Other	7	14
Duration before admission	< 2 hrs	27	
	2-6 hrs	15	
	>6 hrs	8	
Number intubated		16	32
Duration before intubation	<1 hr	10	
	1-6 hrs	3	
	>6 hrs	3	
Patient Status at 24 hrs	Stable	37	72
	Unstable	7	14
	Dead	6	12
Patient status at 72 hrs	Alive	38	76
	Dead	12	24

INTUBATION AND TIME LAPSE BEFORE INTUBATION

Sixteen patients were intubated as shown in figure 1 below. None of the patients had tracheostomy. The time from admission to intubation varied from within 1 hour to 20 hours with a mean of 4 hours (SD± 6) and a range of 1 to 20 hours.

FIGURE 2: Rates of intubation of burns patients (inhalation burns).



- Intubated
- Not intubated

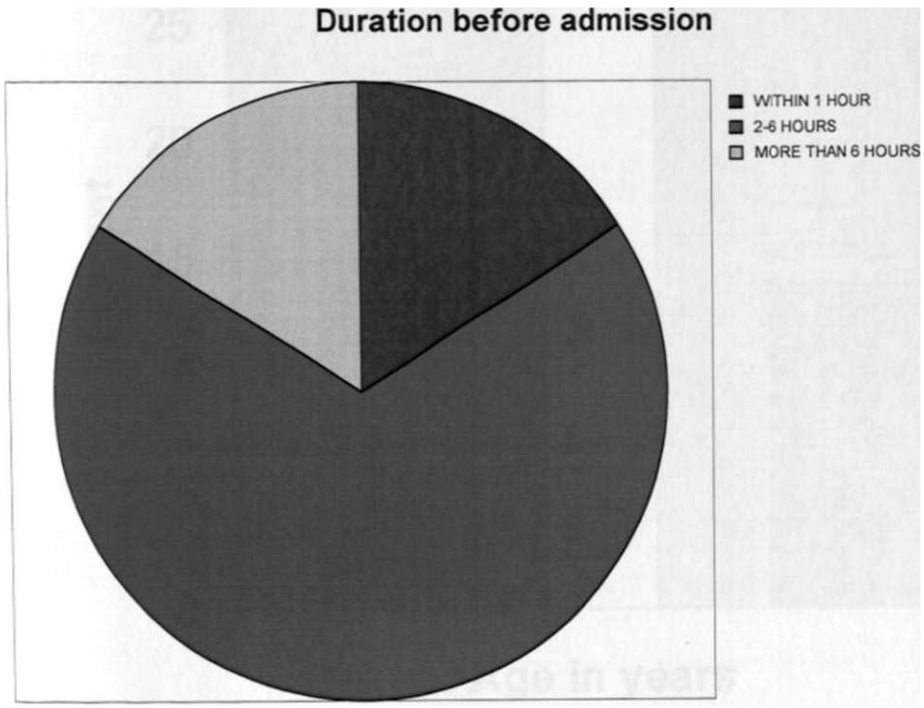
BRONCHOSCOPY FINDINGS

Only two of the patients had endotracheal bronchoscopy findings at intubation documented representing twelve percent of the intubated patients.

DEMOGRAPHIC DATA OF PATIENTS

The duration from time of bum to admission is shown in the chart in figure 2 below.

FIGURE 3: Pie-chart showing patient proportion and duration from burn to admission.



Graph showing frequency of inhalation burns

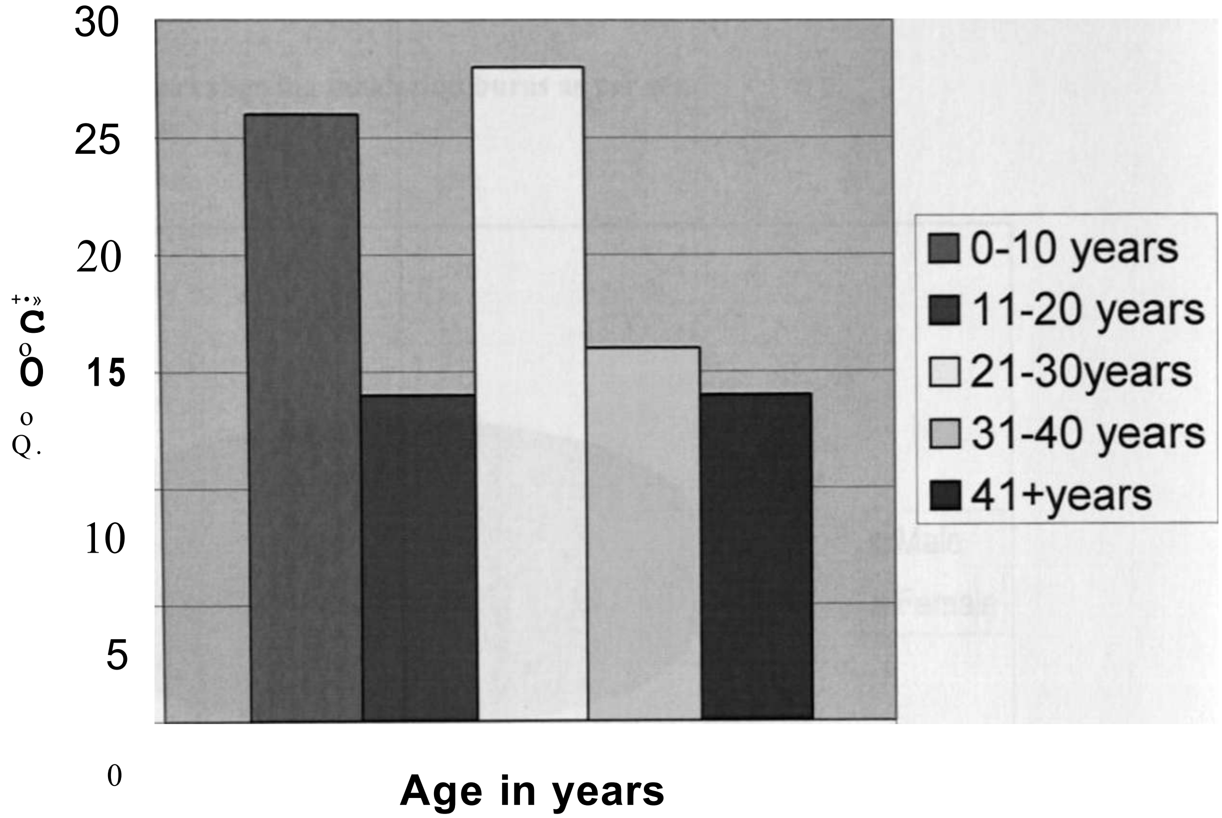


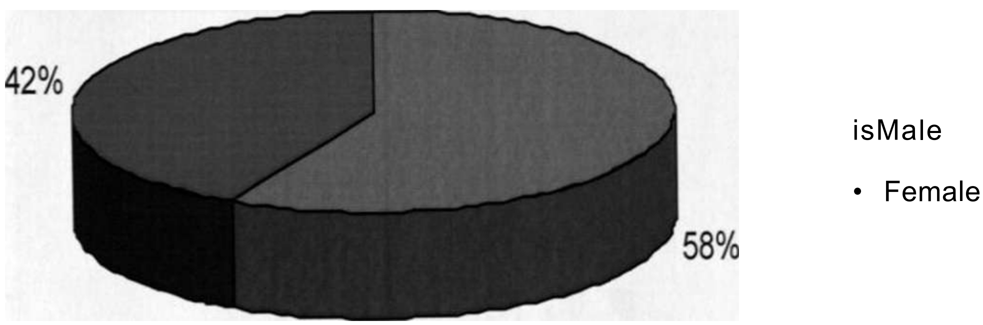
FIGURE 4

This study involved all age groups. The mean age of the patients was 23 years (SD ±15.5) and the range was 0-56 years.

SEX

There was a higher number of males enrolled with a female to male ratio of 1:1.5 as shown in figure 4 below.

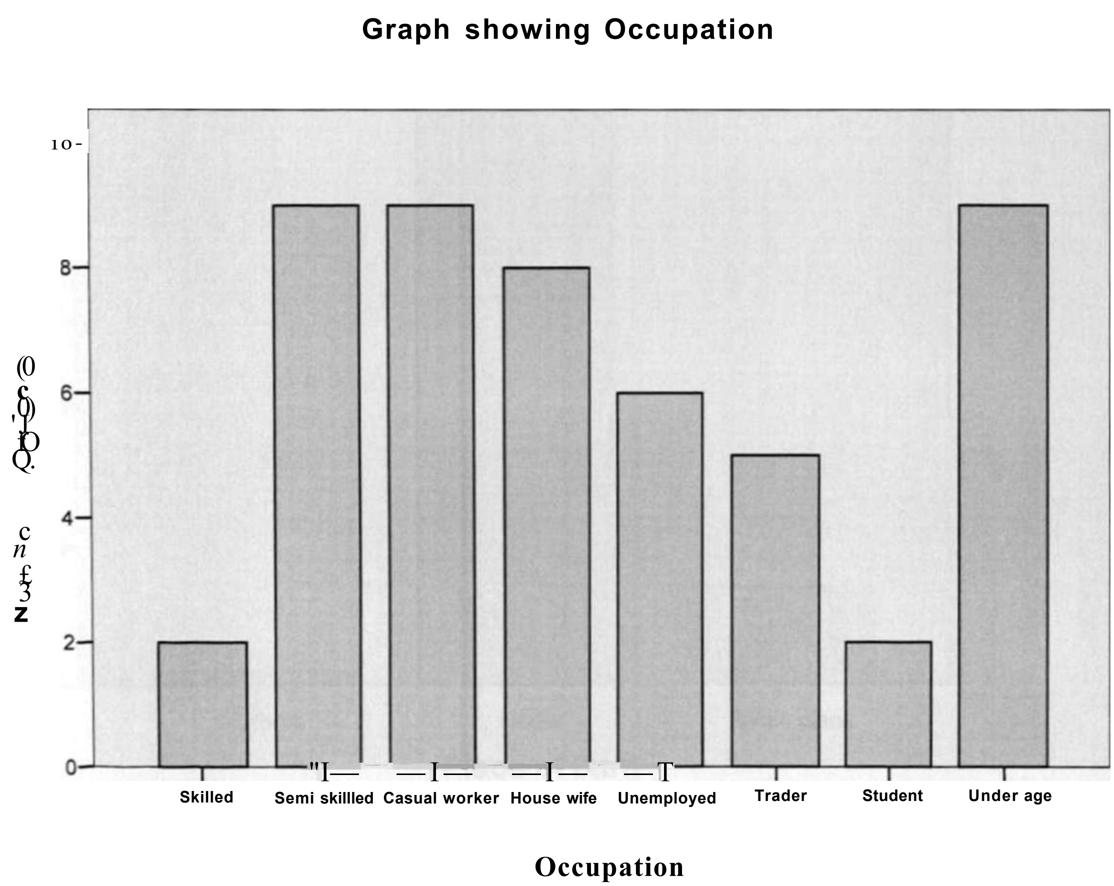
FIGURE 5: Pie chart showing inhalation burns as per sex.



RESIDENCE AND OCCUPATION

All patients enrolled were from the urban/peri-urban low socio-economic settlement areas of the city of Nairobi. Most of these patients were in the low income earner group as shown in figure 3.

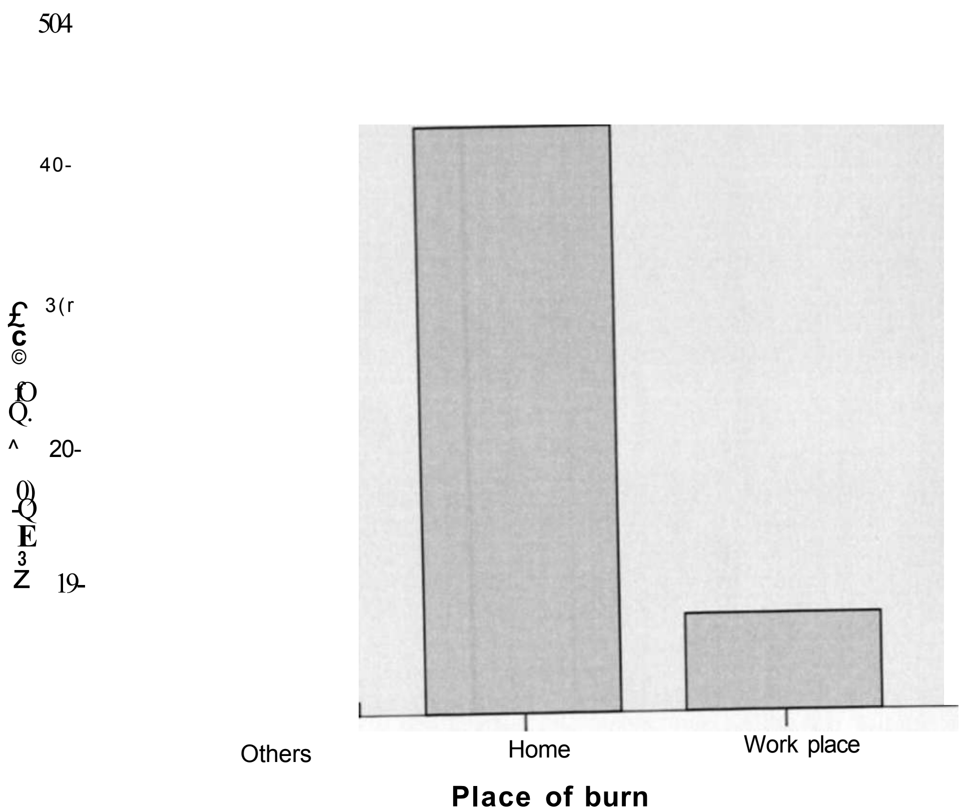
FIGURE 6



PLACE OF BURN

Most of the patients were burnt at home as shown in the graph below.

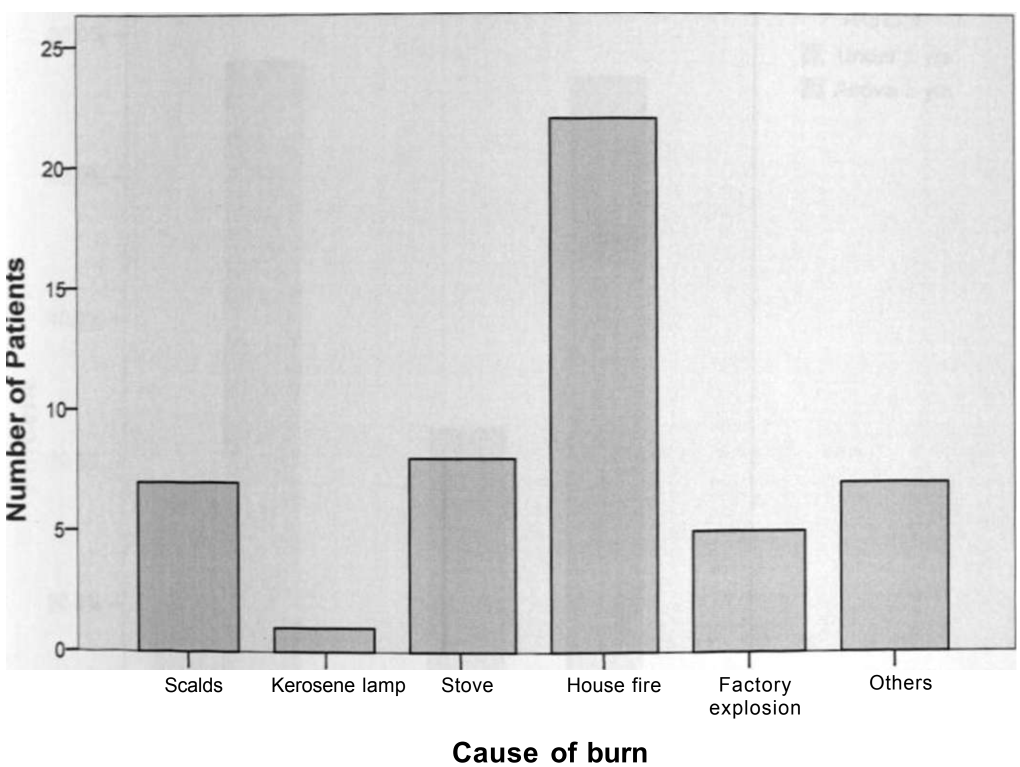
FIGURE 7; Graph showing place of burn.



CAUSE OF BURN

Most patients sustained bums from house fires as shown in figure 7 below.

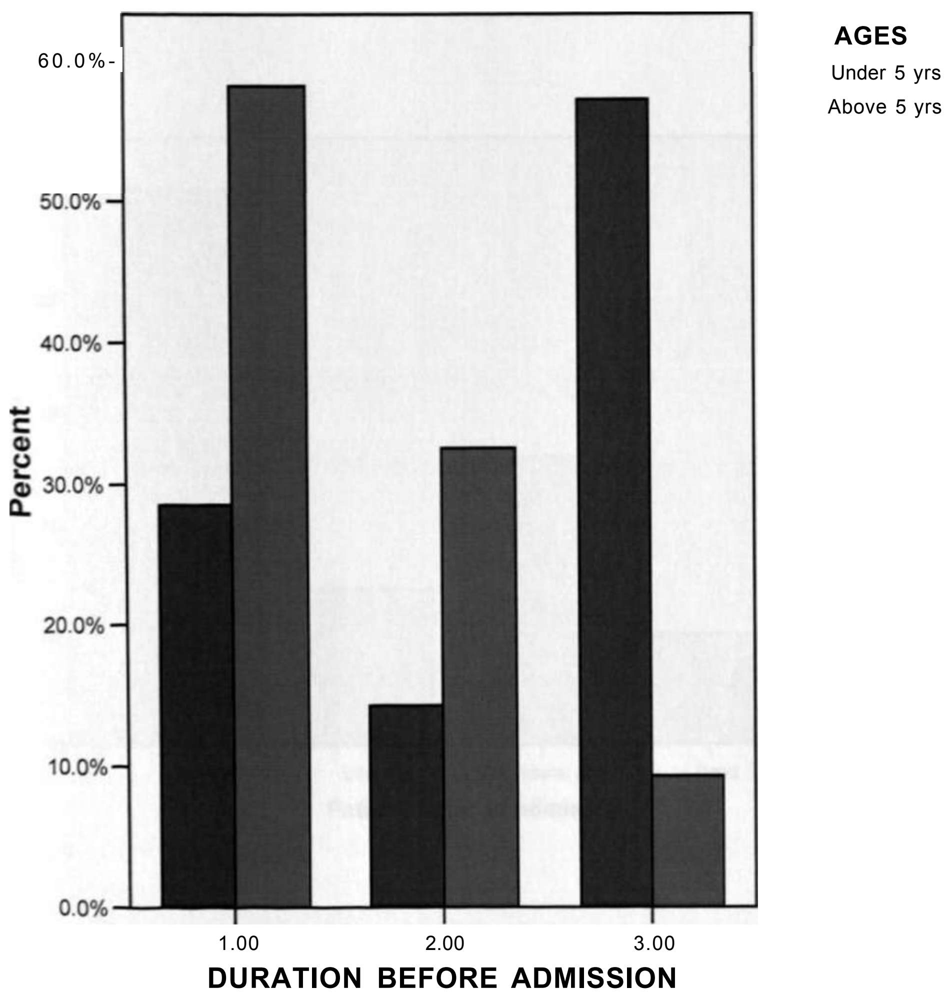
FIGURE 8; Graph showing cause of burn



TIME LAPSE/DURATION BEFORE ADMISSION

The mean time lapse from burn to hospital admission was 4.38 hours. Three quarters of the patients were admitted within 6 hours of injury as shown in the table below. Those aged below 5 years had less delay before presentation to hospital.

FIGURE 9: Graph showing relationship between age and times of admission.



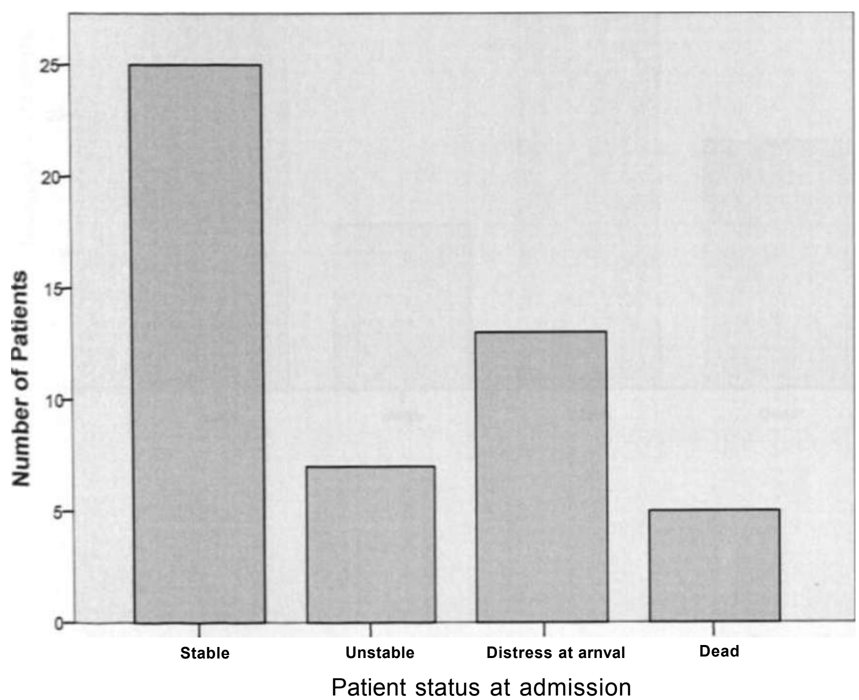
X-**axis; Within 2 hrs=l, 2-6 hrs=2, after 6 hours—3.** Y-**axis=Percentages.**

RISK FACTORS

There were only six patients (12% of the study group) with risk factors to sustaining burns. Those present were alcohol, psychiatric and epilepsy.

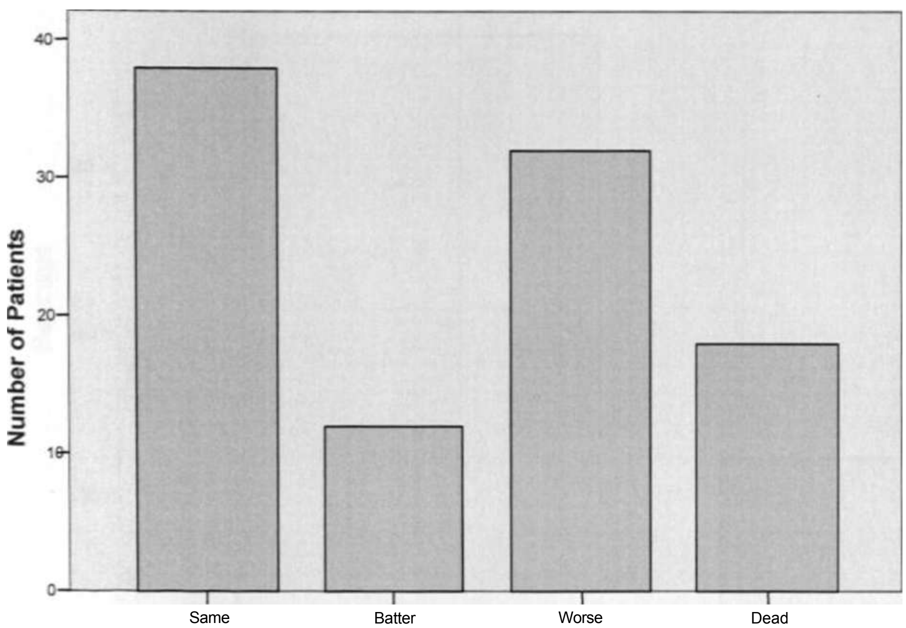
PATIENT STATUS AT ADMISSION

FIGURE 10; Graph showing patient status at admission



PATIENT STATUS AT 24 HOURS

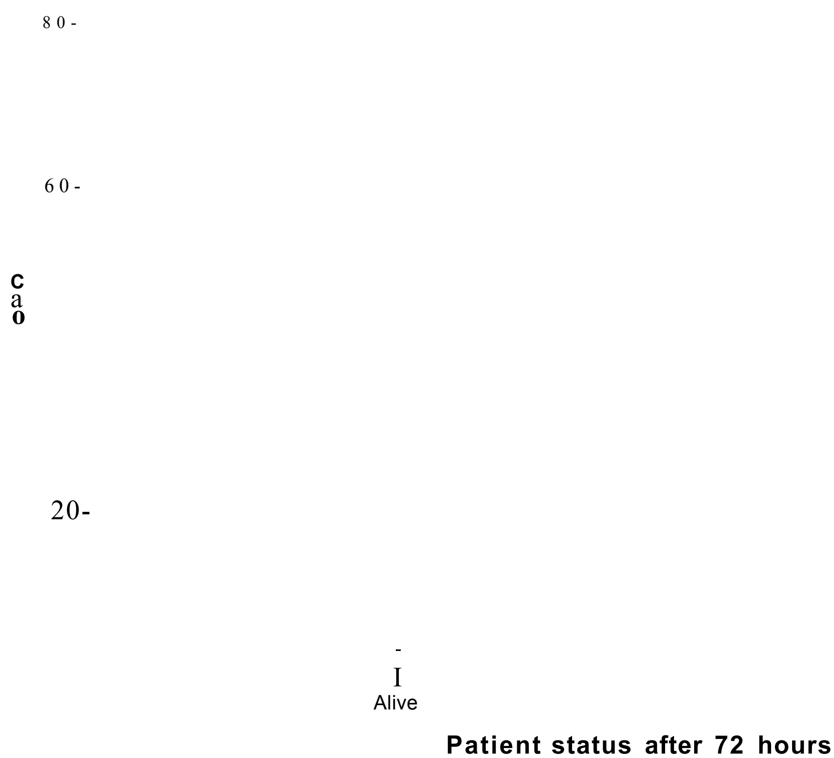
FIGURE 11; Graph showing changes observed in patient status over the first 24 hours post admission.



Nine (18%) of the patients were dead, 6 (12%) had improved respiratory status, 19 (38%) were in same status as admission and 16 (32%) had deteriorated at 24 hours after admission as shown in figure 10 above.

PATIENT STATUS AT 72 HOURS

FIGURE 12; Graph showing patient status at 72 hours.



Twelve of the patients were dead after 72 hours as shown in figure 11 above.

i

TESTS/CORRELATIONS

There was a relation between the age of the patient and inhalation burn with most of the patients under 10 years having aspirated fluids and those over 20 years being closed space fire incidences. The cause, place and circumstances were predictable although they could be unrelated.

There was also a significant change in patient status from admission to 24 hours and 72 hours respectively. The patient status at 24 hr and 72 hr intervals varied in both improvement and deterioration as is expected of any critically ill patient depending on the underlying state, the prognosis and interventions offered.

Young patients were admitted earlier after the injury than adults.

Two of the patients who needed intubation and were intubated within two hours were stable and extubated at 72 hours. None of those intubated later than 6 hours were either extubated or alive at 72 hours as shown in table 6 below.

TABLE 4: Time lapse before intubation and status at 72 hours

	Intubated within 2hrs	**Intubated after2 hrs**	**p value**
Number extubated at 72 hrs	3	3	0.843
Number still intubated or dead at 72 hrs	5	3	0.529

DISCUSSION

The determinants of mortality following bums include TBSA, increasing age, inhalation injury and female sex. This study shows there were less of the extremes of age affected with a mean age of 23 years (SD±15.5). Operative intervention and presence of an upper limb burn decreased the risk of death according to Muller and his colleagues. They noted that the more the risk factors the higher the mortality. [42,43,44]

Prebum morbidity, predisposing factors and psychosocial adjustment to the burn affect outcome. [45.46.47,48]

A study done in Israel found the male gender twice as frequent as female in bum patients with non Jews being more affected. About 2% of the patients had inhalation injury constituting 20% of the severely injured. The majority (58%) occurred at home while 19% were work related.[48] In this study most of the burns injuries occurred at home and were mostly in male as found in Israel unlike the findings by Ashraf in Egypt where there were more female and children." Despite the age grouped results showing that the older patients presented earlier to hospital the means do not suggest this. There are various reasons which may have caused the apparent delay in coming to hospital of the younger age group which include awaiting consent to seek medical care, finances and company to hospital from the fathers of the victims. The adults do not need these especially so for the male adults.

Almost all the patients enrolled in this study reside in the poor urban settlement areas. Although inequalities in socioeconomic status impact on occurrence of burns once patients enter hospital systems there are comparable levels of service and outcomes.[Ml] The fire incidences were more isolated unlike the developed world where venues of mass gatherings are predominant.[13] Most incidences were in homes which confirms findings by Ndiritu who noted this to account for 80.7 % and compares to findings elsewhere.[4"]

In Hawaii there are injury prevention plans and behavioral risk surveillance systems. The emphasis on preventive programmes as adopted in other countries and states like Hawaii, Oklahoma and South Africa involving the community and private sectors reduce morbidity and mortality. That is not done in the set up of this study

The majority of the recruited patients in this study presented within 6 hours of the bum. This is comparable to durations before presentation elsewhere. In a bum unit in Saudi Arabia the majority of patients (79%) were admitted within the first 24 hours.[51]

Of 38 severely burnt patients with TBSA > 40% and having inhalation injury there was mortality of 21 with various early complications ARDS, bronchopneumonia and multiple organ dysfunction.[52]

Bronchoscopy is used in diagnosis of inhalation injury as well as getting quantitative sputum cultures and is useful for ICU antimicrobial adjustments especially in nosocomial infections.[53] This study shows this practice is not common in inhalation bum patients at Kenyatta National Hospital as only two patients had bronchoscopy..

The patient status at 24 hours varied with some deteriorating despite procedures performed. However there was a proportion who faired better after intubation signifying response to a secure airway and other interventions carried out. The findings show most patients with inhalation bum do not require intubation and almost all of them do not require tracheostomy. Approaches to nutrition of severely injured patients in the intensive care setting vary and there is no one accepted protocol for nutritional rehabilitation of severely burnt patients. Whichever mode preferred has to be tailored to individual patients and institutional capacities. [54,55]

Despite intubation and tracheostomy there exist significant upper airway sequelae which although not forming a basis for my study require attention in the long run.[^1 5S] There was reported decrease in severity of burns injuries as well as improved outcomes overtime.[17,59] This does not seem to be the case in this study. There are areas where we can improve in prevention of burn injury at regulation of fuel standards and our care for these patients especially bronchoscopy.

OUTCOMES

There were 16 out of 50 patients intubated with no patient having tracheostomy. This was 32%, which compares to similar figures having intubation in other studies [42].

There were 5 deaths constituting 31% of the 16 intubated patients i.e. can be extrapolated that approximately one third of patients intubated will die.

STUDY LIMITATION

There was lack of routine serum carboxyhaemoglobin and carbon monoxide levels testing in KNH.

There was no routine blood gas analysis for these patients.

The contribution of inhalation bum to outcome specifically mortality may not be determined since there are other factors that influence it in burn patients.

The distribution of various groups in the general population could also not be accurately determined. Due to the sample size and many conpounding factors it was challenging to subject the findings to statistical tests.

i

CONCLUSIONS

Most inhalation burn injuries occurred due to house fires (84%) arising due to stove explosions and at the workplace (factory) (16%). In many cases these occurred while the victims slept.

Inhalation burns occurred in association with other bum injuries. The patients presented early and had high morbidity in this set up. All these patients were admitted to Bums Unit and intubation done without bronchoscopy except in two patients. No credible investigations were done to evaluate and monitor the level of respiratory compromise and the progress in management.

Majority of patients did not present in respiratory distress and only 1/3 required intubation.

RECOMMEN DATIONS

The public health policy should embrace precautionary measures to curb fires by use of stoves given that most of the patients sustained bums from house fires which involved explosions of stoves probably using adulterated fuel. In order to prevent future occurrence of this type of disaster, I suggest that there should be an intense public awareness campaign in the print and electronic media on the danger of refuelling lighted lanterns and stoves. There needs to be legislation requiring that hurricane lanterns and stoves should carry warning labels in the local languages calling attention to the danger of refueling them. This can then be complimented by efforts from oil companies targeting the customers at source.

Since the majority of patients are of low socioeconomic status efforts to improve this as well as housing will reduce prevalence.

The bum care unit needs to make frequent use of laboratory investigation for blood gases and acid base as well as bronchoscopy.

There is need for a clearly outlined protocol for management of inhalation injury bums at Kenyatta National Hospital.

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Appendix 1

1 DATA COLLECTION FORM

I.IDENTIFICATION

% TBSA

(i) Serial NO

(ii) Hospital No

(iii)Name:

(iv) Date of Burn..................Time

(v) Date of Admission............Time

(vi) Duration before Admission

(vii) Admission Ward: 1. ICU |___|

2. Burns Unit CD

II.**SOCIAL DEMOGRAPHIC DATA**

(i). Age..........................Years.

(ii). Sex (a) Male •• (b) Female •

(iii) Residence (a) Urban |___| (b) Rural 1 I

(iv) Marital Status for Pts>18yrs(a) Married ^ (b) Single ^

(v) Highest level of education (parental if child is <15 years.)

l.NIL Q 2.PRIMARY • 3.SECONDARY • 4.C0LLEGE

5.OTHERS •

(vi) Adults occupation 1) Skilled worker I 1 2) Semi skilled

3). Casual laborer tzn 4) Housewife I I 5) Unemployed I 1

Ill SETTING OF BURN INJURIES

(i) Place of Burn (a) Home 1 = 1 (b) Work place 1 = 1 (c) Others

(ii)Circumstancesofburn; (a) Accidental |___1 (b) Intentional. |___|

IV.CAUSE OF BURN INJURY

(a) Hot liquids|___1

b) Flame bum

I. Kerosene lamp I___1

II. Stove

III. Charcoal Burner (Jiko) I I

IV. House fire I—I

V. Others (specify)

(c) Chemical burn

I. Cement/fertilizers/Insecticides |___1

II. Cleaning agents

m. Petrol/ Tar

IV. Others •

(d) Radiation Bum

1 . S u n Q 2) Hunters| 1 3) Welding •• 4) others |___|

Risk factors for burn

L Diabetes| 1 2. Blindness I I 3. Epilepsy ••

4. Psychiatric illness. I 1 5. Smoking/Alcohol |—j

(v) Indications of inhalation injuries

1) Facial burns |___1

2) Burned moustache/nostrils/singed hair I___I

3) Stridor•

4) Dyspnoea |___1

5) Carbonaceous sputum |___1

6) Decreased level of consciousness in a burning environment I 1

(vi) Classification of inhalational injuries.

1. Patient with definite evidence of smoke inhalation but showing no respiratory insufficiency within first 24 hours post burn I___I

2. Patient with developing respiratory insufficiency within the first 24hours. Post burn I I

3. Patient present with intense distress symptom on arrival I___I

4. Patient dying on arrival or within 24hrs with burns injuries involving respiratory (=• system

(vii) Time of intubation in hours after admission ' '

(viii) Bronchoscopy done |___1

(ix) Bronchoscopy not done |___1

(x) Acid base status 24hrs 1. Normal [! • 2 Others (specify) ___1

72hrs 1 .Normal 2 Others (specify) |___1

(xi) Arterial Blood Gas measurement 1. Normal I___I 2. Deranged I___I

b) Patient status at admission

1.Normal consciousness ' 1 2. Reduced consciousness I '

c) Patient status at 24 hours

1.Same ^ 2. Better 1 = 1 3.worse ^ 4. Dead. ^

5) Don't know 1 '

d) Patient status after 72hrs

1) Extubated ^ 2) Still intubated • 3 Dead. •

Appendix 1

ABBREVIATED BURN SEVERITY INDEX

Sex Score

Female. .1

Male.. 0

Age, years

0-20.. 1

21-40.. 2

41-60.. 3

61-80.. 4

81-100.. 5

Inhalation injury..*

Full thickness burns

Total Body surface Burn, %

1-10

11-20

21-30

31-40	4
41-50	5
51-60	6
61-70	7
71-80	8
81-90	9
91-100	10

Total Burn Score	Threat to life	Probability of survival
2-3	Very low	.99
4-5	Moderate	.98
6-7	moderately severe	.8-.9
8-9	Serious	.5-.7
10-11	Severe	.2-.4
12-13	Maximum	<.1.0

Appendix 3

INFORMED CONSENT FORM

I

parent guardian of..having been fully informed about this study on occurrence and management of inhalation burns by Dr Shisanya K. S. A. do allow him interview, examine, manage and follow up my patient during the period of management of his or her injuries.

I am fully informed no untoward management methods will be used in the care of my patient and neither will relevant treatment be withheld from my patient during the study period. No payment will be made as an incentive for participation in the study.

I am allowed to withdraw from the study without being denied any relevant treatment and. or suffering any discrimination or intimidation.

Patient'parent/guardian: Witness:

Name.................................... Name

Signature...................................... Signature

Date... Date

Investigator

Name

Signature

Date

Contact: Dr. Shisanya K.S.A. Box 1544- 00200 Nairobi.

Tel. 0722617243

SWAHIM FORMAT

Mimi ni Dr Shisanya K. S. A. kutoka Chuo Kikuu cha Nairobi, Idara ya Upasuaji. Ninafanya utafiti kuhusu madhara ya janga la moto haswa kuhusu madhara yanayo tokana na kuunguwa kwa mapafu na koo. Nikipata hali isiyostahili, nitamjulisha daktari wako haraka sana ili marekebisho yafanywe.

Utafiti huu umeidhinishwa na tume ya maadili mema katika utafiti ya hospitali ya Kenyatta. Hakuna madhara yoyote tunayokusudia kutokana na utafiti huu. Mbali na hayo wagonjwa wa maafa ya moto wanaweza kufaidika baada ya utafiti huu. Hakuna pesa utakazolipwa kwa kuhusika na utafiti huu.

Ni haki yako kukataa kushirikishwa katika utafiti huu na hili haliwezi kukuzuia kupata matibabu mwafaka ukiwa katika hospitali hii. Aidha waweza kujiondoa kwenye utafiti huu wakati wowote.

Hakuna habari zozote zitakazotolewa kwa watu wenginc bila ruhusa uliyotia sahihi mwenyewe. Kila habari kukuhusu zitalindwa kikamilifu. Unaweza kuuliza maswali wakati wowote kama hujaridhika kwa vyovyote. Nakutakia kupona haraka.

Tia sahihi kwenye nafasi uliyoachiwa hapa chini kama ishara kwamba umeelewa na umekubali kushirikishwa katika utafiti huu.

Fomu va kusaiiliwa

Baada ya maelezo kuhusu utafiti huu, mimi nimekubali kusajiliwa katika zoezi hili.

Mgonjwa ama Anayemtunza........................Tarehe

Shahidi..Tarehe

Mtafiti..Tarehe

Anwani: Dr.Shisanya K.S.A. P.O. Box 1544-00200 Nairobi, Kenya. Tel: 0722617243

CSS3

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QUALITY HEALTH CARE

Ref: KNH-ERC/ 01/ 4564

16th July 2007

Dr. Shisanya K
Dept. of Surgery
School of Medicine
University of Nairobi

Dear Dr. Shisanya

RESEARCH PROPOSAL: "OCCURRENCE AND EARLY OUTCOMES OF INHALATION BURNS IN BURN INJURY PATIENTS ADMITTED TO K.N.H: A REFERRAL BURNS CENTRE IN EAST AFRICA" (P146/6/2007)

This is to inform you that the Kenyatta National Hospital Ethics and Research Committee has reviewed and approved your above cited research proposal for the period 16th July 2007 - 15th July 2008.

You will be required to request for a renewal of the approval if you intend to continue with the study beyond the deadline given. Clearance for export of biological specimen must also be obtained from KNH-ERC for each batch.

On behalf of the Committee, I wish you fruitful research and look forward to receiving a summary of the research findings upon completion of the study.

This information will form part of database that will be consulted in future when processing related research study so as to minimize chances of study duplication.

Yours sincerely

DR. L. MUCHIRI
Aq. SECRETARY, KNH-ERC

c.c. Prof K M. Bhatt, Chairperson, KNH-ERC
The Deputy Director CS, KNH
The Dean, School of Medicine UON
The Chairman, Dept. of Surgery, UON
Supervisors: Prof. Zipporah Ngumi, Dept. of Surgery, UON
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