Hot Cooking Oil Burns: A 20-Year Experience

Katherine Gray, MBBS, Eddie Cheng, MBBS, Stuart Pegg, FRACS

Hot cooking oil burns resulted in 316 admissions to the Burns Unit at The Royal Brisbane Hospital between January 1, 1981, and December 31, 2000. Notable demographics of this group were a male:female ratio 1.74:1 and that 24% of all patients were between the ages of 16 and 20. Workplace burns accounted for 6% of admissions only, but these tended to be of a larger total body surface area involvement. The mean duration of admission was 8.5 days, with 40% of patients undergoing surgical débridement and split-skin grafting. Two hundred thirty-nine patients had 5% or less TBSA burned, most commonly involving the hands, legs, feet, and the forearms. No patients in our study died. The proportion of patients undergoing débridement and grafting increased from zero patients at commencement of this study to a peak of 82.5% in 1998. We believe this reflects changing practice with earlier excision and grafting trying to achieve the best functional and cosmetic results. The lack of predisposing factors and the accidental nature of these burns mean appropriate prevention strategies are paramount to decreasing the number of burns of this type. Suggestions discussed include school-based education programs, warning labels included in product information, and mandatory fire blankets within the home. (J Burn Care Rehabil 2004;25: 205–210)

Burns remain an important and largely preventable source of morbidity in the community. Burns caused by cooking oils, especially in the home, continue to result in a significant amount of injury. How can this be reduced? To address this question, our study identified the clinical details, demographic information, predisposing factors, and most common patterns of injury in patients with hot cooking oil burns over a 20-year period. These findings were then used to propose possible methods of prevention that could be implemented specifically toward a target audience. It is hoped that this information will lead to greater public awareness of the dangers of cooking with hot oil and to a reduction in the incidence of burns of this type.

METHODS

Details of admissions to the Burns Unit at The Royal Brisbane Hospital with hot cooking oil burns from January 1, 1981, to December, 31, 2000, were recorded prospectively for analysis. Patients included in the study were greater than 15 years of age. The data collected included age, sex, burn depth and size, anatomic distribution of burn, mechanism of injury, predisposing factors, year of admission, duration of admission, operative intervention, and outcome.

From the Burns Unit, The Royal Brisbane Hospital, Brisbane, Queensland, Australia.
Address correspondence to Katherine Gray, MBBS, The Royal Brisbane Hospital, Herston Road, Herston, Queensland, Australia.

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RESULTS AND DISCUSSION

Admission

During the 20-year period of this study, 3766 patients were admitted to the burns unit. Of these, 316 (8.4%) resulted from hot cooking oil burns. This figure is very similar to a previous study at the same hospital between 1967 and 1981, when 8.7% of burn admissions were the result of cooking oil burns,[1] but higher than the 4.7% reported in a Minnesota study between 1976 and 1985.[2] Comparatively, the precedence of other causes of burns during this period included gasoline 11%, boiling water or steam 6.5%, motor vehicle accidents 4.7%, kerosene or methylated spirits 3.5%, gas oven explosions 3.4%, and cigarettes 2.9%.

The number of patients admitted each year is documented in Figure 1. A linear trend line applied to this data reveals a downward trend of admissions of

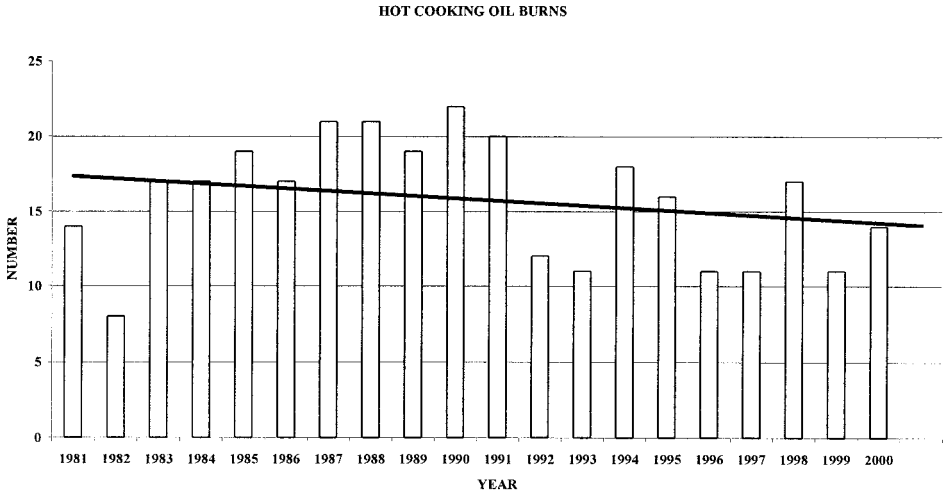

Figure 1. Number of hot cooking oil burns per year, 1981 to 2000.

hot cooking oil burns during the duration of this study.

Sex and Age

Of the 316 patients admitted, 201 (64%) were male and 115 (36%) were female. This discrepancy between the sexes remained stable during the 20-year period and is higher than found by Pegg[1] (55:45%) and Schubert[2] (54:46%). However, this sex distribution is similar to a recent study in Hong Kong, where burns of all etiologies were included (64;36%).[3]

Five-year age groups and sex distribution of each age group are documented in Figure 2. The largest number of individuals was clustered in the 16 to 20 age group (n = 77), which comprised 24% of the total. This group was followed by individuals aged 21 to 25 (n = 67; 21%) and then by those aged 26 to 30 (n = 45; 14%). Those aged 16 to 30 comprised 59.8% of the total study group. Groups 31 to 35, 36 to 40, and 41 to 45 all consisted of 27 individuals. Those aged 46 to 80 constituted 14.5% (n = 46) of the total study group. Of this group, there was a peak incidence (n = 11) in the 56-year-old to 60-year-old group. Notably, all age groups except those aged between 66 and 75 have a higher number of males burnt by hot cooking oil. The widest variation between

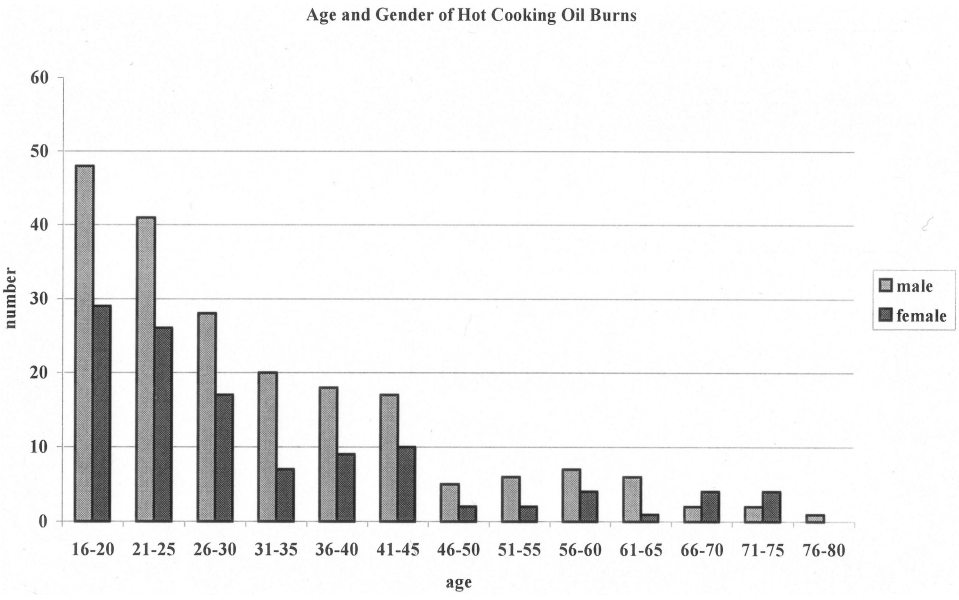

Figure 2. Age and sex distribution of hot cooking oil burns.

sexes is noted in the 61 to 65 age group (85% male: 14% female) and the closest in the 21 to 25 age group (61% male:39% female). Age groups 16 to 20 and 26 to 30 both had a sex distribution of 62% male:38% female. Overall mean age was 32.7, whereas the median age was 28.

Situation

In 19 cases (6%), the burns occurred within the workplace. This figure is lower than previous studies at the our hospital,[1] where higher proportions were attributable to industrial situations (25% July 1967 to June 1972; 17% July 1972 to June 1977; 12% July 1977 to June 1981) and also lower than a Minnesota study (1976–1985),[2] where 21% occurred within the workplace.

Workplace burns tended to be of a larger TBSA involvement (mean value, 8.2% TBSA) than those that occurred within the home environment (mean value, 5% TBSA). This figure is similar to a Utah study in 1991, which looked specifically at hot oil burns at fast food restaurants,[4] where a mean value of 7.4% was found. This increased TBSA may be reflective of the larger quantities of cooking oil used in the work environment. Hot cooking oil burns that were a result of workplace accidents were also more likely to require débridement and grafting during admission.

Predisposing Factors

In only three cases were the burns a result of nonaccidental injury. These were situations arising from epilepsy and domestic violence.

Marital Status

Being in a married or de facto relationship (37% and 11%, respectively) did not affect the risk of cooking oil burn (cf single, 52%).

Duration of Admission

The average duration of admission was 8.5 days for hot oil burns, and this has not varied over the last 20 years. Comparatively, the duration of admission for all burns patients and all surgical patients was 9.81 and 3.89 days, respectively.

Extent of Burns and Mortality Rates

The extent of TBSA burnt at time of admission is shown in Figure 3. Two hundred thirty-nine (76%) of the 316 admissions had 5% or less TBSA involvement. None of the patients in this study required intubation or intensive care admission. None of the 316 patients in this 20-year study died.

Site of Burn Involvement

The number of patients with involvement of the hands, forearms, face, chest, abdomen, and legs and feet is shown in Figure 4.

Depth of Burns

Approximately one third (31.8%) of patients with cooking oil burns sustained full-thickness burn injury. This extensive tissue damage is related to the physical properties of cooking oil—temperature, specific heat, and viscosity.[2]

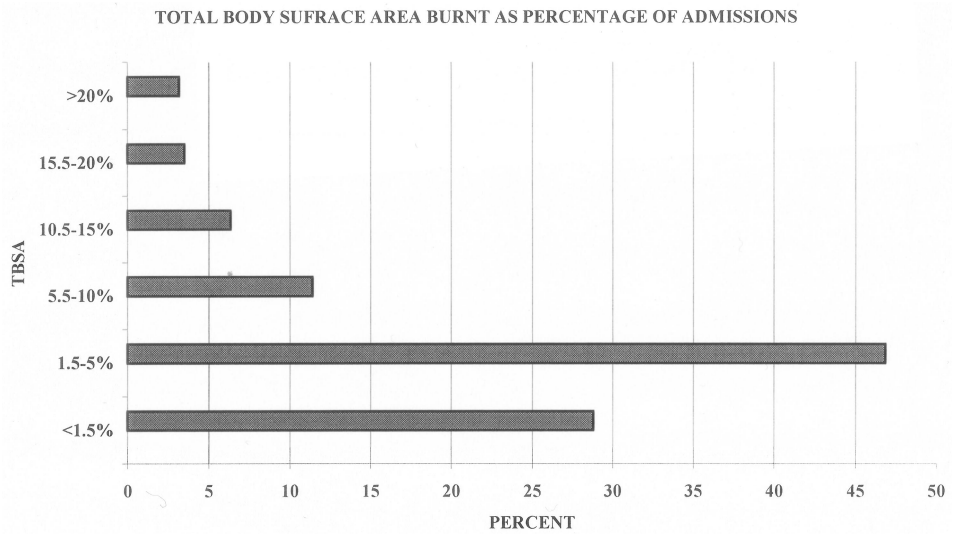

Figure 3. Total body surface area involvement.

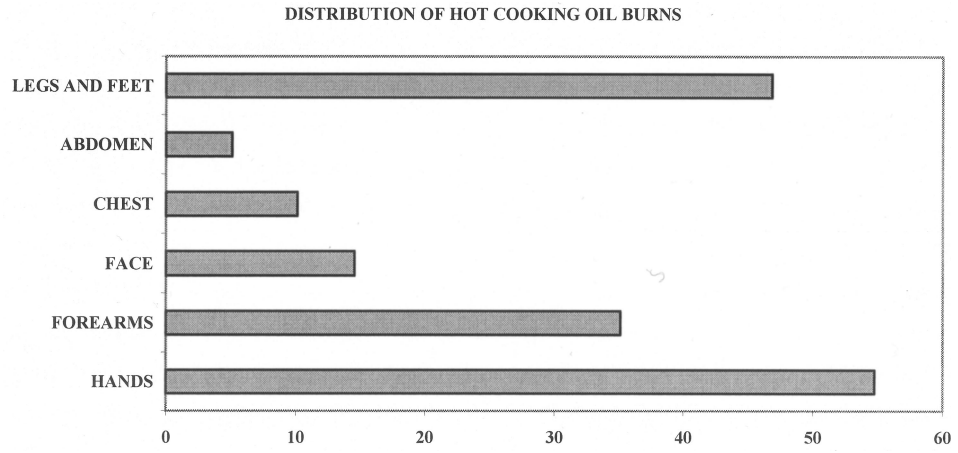

Figure 4. Distribution of burn involvement.

Surgery

One hundred twenty of the 316 admissions (38%) underwent surgery for débridement and split-skin grafting during the period being studied. The percentage of patients admitted to undergo skin grafting has increased over the years in contrast to the average TBSA involvement, which has remained stable as depicted Figure 5. Linear trend lines applied to these data help illustrate these points.

Involvement of Admissions

Because of the deeper nature and the anatomic distribution of cooking oil burn, a considerable portion of patients required surgical intervention despite the small TBSA of burn involved (Table 1).

DISCUSSION

The most marked trend in this study is the increased proportion of hot oil burns being grafted during admission. This value was zero patients at commencement of this study to a peak value of 82.5% of admissions in 1998. For all burns regardless of etiology, it has been recommended that patients undergo early excision and grafting,[5] a practice followed at The Royal Brisbane Hospital. Furthermore, because hot oil burns frequently involve one of the most functional parts of the body—the hand (55% of total individuals affected)—and because hot oil causes deeper thickness burns because of its physical properties of high viscosity and high boiling/flash point,[2,6] aggressive surgical therapy will produce the best functional and cosmetic results.[7] Thus, although the amount of injury in terms of TBSA involvement has not changed significantly over the 20-year period, more patients with hot oil burns undergo surgery in an attempt to provide the best chance of "normal" function and cosmetic results.

Another important finding from this study is the large proportion of burns of this type occurring

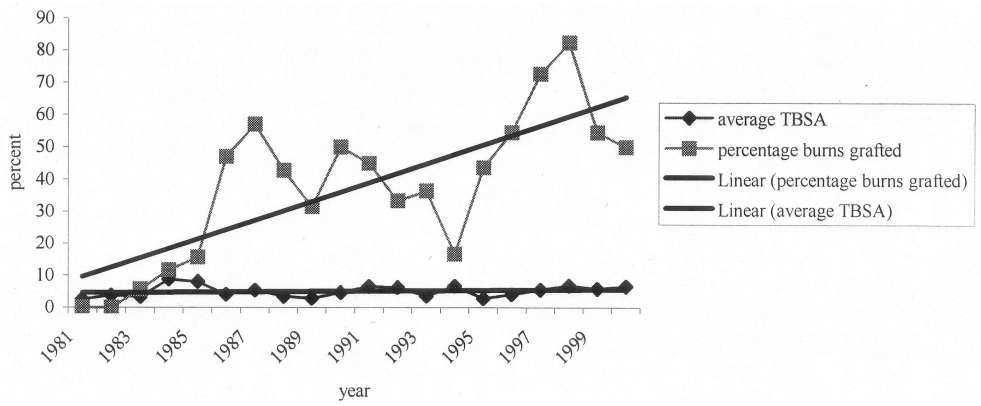

Figure 5. Percentage of admissions requiring grafting and average surface area.

Table 1. Comparison of total body surface area burn to surgical intervention

% TBSA burns	1	2–5	6–10	11–15	16–20	>20
% Required surgical intervention	24	34	41	38	45	50

within the domestic setting and the lack of predisposing factors. After studying the situations in which hot cooking oil burns occur, two main mechanisms of injury prevail to cause burns after cooking oil has spontaneously ignited when heated in an inappropriate vessel. First, the burning oil is removed from the house to prevent spread of the fire in the kitchen and destruction of property and during transport the burning oil is spilled on the individual. Alternatively, the individual may decide to attempt extinguish the fire with water, leading to explosions and splash burns. Both of these actions explain the predominant distribution of burns involving hands, forearms, and feet and the relative lack of involvement of faces and the thorax. Furthermore, because these burns are accidentally self-inflicted, they are of limited TBSA involvement. Other modes of injury identified include accidentally knocking the cooking utensil off the heat source and moving deep fryers to dispose of contents before allowing cooling to occur, although these occur in a minority of situations. Occasionally, more extensive burns have resulted from the patients' clothing becoming ignited as well.

Our study confirms earlier observations of young people between the ages of 16 and 30 being at the greatest risk for burns of this type.[1,2] An increased ratio of males to females involved in hot oil burns in this younger age group is also consistent with earlier reports[1]; however, this variation between sexes has widened in our study. Previously,[1] it has been hypothesized that this is a result of males taking over control of the situation should oil ignition occur during the cooking process. Perhaps it may also be attributed to the changing social climate in Australia, where young men are increasingly living independently and thus cooking more meals or sharing more household responsibilities in relationships.

Although this study demonstrates that the number of hot cooking oil burns being admitted to hospital have decreased over a 20-year period, we do not believe this represents a decline in the total number of burns of this type. A limitation of this study is it only included inpatients under the care of the burns unit at the Royal Brisbane. However, outpatient services at the Royal Brisbane Hospital have increased substantially over the 20-year period. Increasingly, if a patient does not require admission for surgery or pain management, they will be managed as an outpatient presenting for weekly follow-up initially. This outpatient management is achievable as a result of improved wound management and dressings and the increasing availability of community support services. Thus, this work shows a selection bias in relation to the number and the severity of burns of this type. Interestingly, however, an increase in outpatient services has not resulted in a decreased hospital length of stay. As stated above previously, hospital stay was for wound care and dressings, whereas in recent years hospital beds have been used for the increasing number of patients requiring preoperative and postoperative management, with most burns patients remaining within hospital until day 5 dressing changes. We believe that in the coming years, a decline in duration of stay will occur as community resources are further used.

Prevention

The importance of epidemiological studies is that they can be used to identify populations at increased risk upon whom interventions to decrease the incidence of such injuries can be focused.[8] Hot cooking oil burns do not cause significant mortality but in many cases result in lifelong morbidity because of physical, functional, social, and psychologic factors. Especially because young populations are at risk, it results in considerable loss in community productivity and also a financial burden on our health care system. When such a large proportion of hot oil burns are attributable to accidents, appropriate prevention strategies are paramount to decreasing the number of burns of this type. Prevention requires an integrated approach drawing on the resources of government, schools, and the health system. It can be broken down into three factors: host (person at risk), agent (hot oil), and environment using the public health model.[9] First, school-based education programs could be implemented that focus on appropriate courses of action should cooking oil ignite, thus educating those in younger age groups who are at greatest risk. Too frequently individuals respond to hot oil fires by trying to transport the burning liquid out of harms way, thereby placing themselves directly in it or by attempting to extinguish the fire by using water, resulting in splash burns. Also, the importance of ed-

ucating the use of only properly designed cooking containers should not be forgotten.

Fortunately, several properly designed devices for cooking with hot oil are already available for purchase. However, warning labels about the danger of cooking with hot oil and what to do in the event of ignition are not prominent on packaging, if present at all. The inclusion of these precautions on these products in a prominent position in clear writing of a different color should become mandatory. Also, all cooking oils plus products used in deep fryers, for example, frozen foods, should similarly have the precautions displayed.

Finally, the home kitchen, where 94% of our hot cooking oil burns occurred, needs to be modified to become safer. A simple fire blanket or fire extinguisher should become part of every kitchen so that fire can be smothered quickly and simply thus preventing burns and damage to property. If individuals had access to a blanket, they should be less like to try and transport a burning pot outside or attempt to extinguish the fire with water. A fire blanket should also help reduce burns of other etiologies within the home.

REFERENCES

1. Pegg SP, Seawright AA. Burns due to cooking oils—an increasing hazard. Burns 1983;9:362–9.
2. Schubert W, Ahrenholz D, Solem L. Burns from hot oil and grease: a public health hazard. J Burn Care Rehabil 1990;11:558–62.
3. Ho W, Ying SY. An epidemiological study of 1063 hospitalized burn patients in a tertiary burns centre in Hong Kong. Burns 2001;27:119–23.
4. Hayes-Lundy C, Scott Ward R, Saffle JR, Reddy R, Warden GD, Schnebly WA. Grease burns at fast food restaurants adolescents at risk. J Burn Care Rehabil 1991;12:203–8.
5. Janzekovic Z. A new concept in the early excision and immediate grafting of Burns. J Trauma 1970;10:1103–9.
6. Bill TJ, Bentrem DJ, Drake DB, Edlich RF. Grease burns of the hand: preventable injuries. J Emerg Med 1996;14:351–5.
7. Parry SW. Reconstruction of the burnt hand. Clin Plast Surg 1989;16:577–86.
8. Rivara FP. Burns: the importance of prevention. Inj Prev 2000;6:243–4.
9. McLoughlin EA. Simple guide to burn prevention. Burns 1995;21:226–9.