

RABIES AND DOG BITE IN CHILDREN: A DECADE OF EXPERIENCE IN SOKOTO, NIGERIA.

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Abstract

A prospective study of cases of rabies in children in two major hospitals in Sokoto over a decade (1980 to 1998) was complemented with a retrospective analysis of dog bite injuries in children seen in these hospitals and the Veterinary Centre during the same period. Data on rabies control by the relevant State Ministry were also analysed. There were 11 children with rabies (6 males, 5 females, aged 3 to 13 years, mean = 7 years). All had history of dog bite, but in only 2 cases was postexposure antirabies vaccination commenced. The incubation period ranged from 1 - 3 months (mean = 1.7 months). Mortality was 100%. Survival after the first symptom was short (3 - 6 days). Of the 991 victims of dog bite seen in the veterinary centre, 624 (63%) were aged < 12 years. Majority of the bites occurred in the dry hot season (March to June). Of the 370 cases of dogbite seen in the hospitals 242 (65%) were children aged 3.5 - 11.75 years (mean = 8.1, SD \pm 2.5 years). Injuries were of grade II and III severity in 183 (88%) cases. Bites on the head and neck were commonest in children under 5. Post exposure prophylaxis was inappropriate or incomplete in the majority of cases. The majority of the dogs were stray. Most dogs are no longer vaccinated, because the veterinary enforcement machinery has collapsed, and the cost of vaccination has escalated. A new strategy to control rabies in Nigeria is urgently needed, and should include efforts to educate health workers on the proper management of dog bite and the enforcement of the existing legislature on dog population control and the vaccination of dogs.

Key Words: Dog Bite; Rabies; Children, Nigeria.

Introduction

An effective rabies vaccine was first developed over a century ago, making human rabies a preventable disease (Sureau, 1988). The disease has been completely eradicated in Britain for the last three decades and constant vigilance is kept to ensure that the disease is not re-introduced by wild foxes in Europe (Warrel, 1977). Human rabies is, however, by no means rare in developing countries (Lindtjorn, 1982; Bogel and Motschwiller, 1986; Kureishi *et al*, 1992) including Nigeria, where transmission to man is most often from dogs (Lindtjorn, 1982; Bogel and Motschwiller, 1986; Kureishi *et al*, 1992; FAO, 1996). Rabies is currently regarded as enzootic in Nigeria (FAO, 1996; Taiwo *et al*, 1998).

The more recently developed human diploid cell vaccine (HDCV) is very safe and effective. This vaccine and immune globulin together reduce the risk of infection from around 15% - 1% of bites by a rabid

animal (McDavidson, 1993). Yet, these powerful post exposure prophylactic agents are scarce and not easily affordable in Nigeria. Specific therapy in rabies is useless once symptoms have begun, and death ensues in almost all cases, although intensive care has helped a few patients with possible rabies to survive (Hattwick *et al*, 1972; McDavidson, 1993). By far the most important factor is still prevention and control of the disease which involves many aspects including proper management of dog bite injuries, appropriate post-exposure prophylaxis, dog population control, immunization of dogs and continuous surveillance (WHO, 1984).

Reports on both dog bite injuries and rabies in Nigerian children are scanty (Bryceson *et al*, 1975; Warrel *et al*, 1976; Kale, 1976). Yet, it is known that the risk of progression of clinical rabies is greater in young children than in adults (Robinson, 1976). In the present study we review 10 years experience of clinical rabies

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in Nigerian children and complement this with a 10-year retrospective analysis of dog bite injuries in children and also review the relevant veterinary public health data on control of rabies in the last 10 years in one Nigerian State. Our aim is to highlight some epidemiological, clinical, management and preventive aspects of dog bite injuries and rabies in Nigerian children. By so doing, we can make appropriate recommendations for the proper management of dog bite injuries, and for improvement in our strategy for the prevention of human rabies in general and in children in particular.

Materials and Methods

All consecutive cases of rabies in children seen in the Specialist Hospital, Sokoto (SHS) between December 1989 and October 1998, and those seen in the Usmanu Danfodiyo University Teaching Hospital (UDUTH), Sokoto between January 1992 and October, 1998 were prospectively studied. The diagnosis of rabies was entirely clinical and was based on criteria similar to those used by Lindtjorn (1982) in Ethiopia and Kureishi *et al* (1992) in China. The basis of the clinical diagnosis was provided by the clinical picture - with hydrophobia being the most important sign and also by the fatal course of the disease and history of dog bite in all cases. In no case was postmortem brain examination done, nor was serological confirmation of rabies carried out at the hospitals; nor was it standard practice to send serum specimen to reference laboratories. However, in view of the distinct clinical syndrome presented by rabies, the strict case definition was considered adequate for the purpose of the study.

Historical data recorded for each patient included age, sex, address, site of bite. It also included whether post exposure prophylaxis was given or not, the type of prophylaxis given; duration of illness - defined as the interval between onset of symptoms and death i.e. length of survival after the first symptom and duration of stay in hospital.

A full neurological examination was conducted on all patients at the time of admission followed by a daily review of the clinical signs. Detailed clinical examination of other systems was similarly conducted. The following clinical signs were specifically looked for at the time of examination: apprehension, restlessness, hydrophobia, aerophobia, paraesthesia

at the site of wound, ataxia, excessive thirst, fever (defined as temperature $> 38^{\circ}\text{C}$), maniacal behaviour, anxiety, visual, olfactory, auditory hyperexcitability, repeated generalized convulsions, flaccid paralysis, and coma.

Information recorded on the dog involved included ownership and whether stray. A dog was considered to be stray if either the patient, the parents or relation could not identify its owner.

The prospective study on rabies was complemented with a retrospective analysis of dog bite injuries in children seen in the SHS, UDUTH, and the Sokoto State Veterinary Centre (SSVC). Information recorded on each patient included: age, sex, date bitten, duration from bite to presentation, whether bite was provoked or unprovoked, site of bite, severity of dog bite injury, which was graded according to the method proposed by Kureishi *et al* (1992) as follows: grade 0: no apparent injury seen grade 1: skin scratched with no bleeding; grade 2: minor wound with some bleeding; and grade 3: deep or multiple wounds or any wound requiring suturing; whether patient was admitted or not, type of postexposure treatment given including postexposure rabies vaccination, date given, and how long after the bite, type of vaccine given, whether schedule of immunisation was completed or not, immediate reaction to vaccination if any, duration of follow-up, late complications of vaccination if any, whether passive immunisation was given or not, type of immune globulin given and reactions if any, and whether patient subsequently developed rabies or not.

With regards to the dog involved information extracted from the records included: ownership, whether the dog was killed or not, antirabies vaccination status (if known), whether dog was observed after the bite and for how long, whether dog remained alive after a 10-day observation period or not, whether bite was provoked or unprovoked, number of other victims bitten if known, their ages and sex and whether dog bite injury was reported to the SSVC or not.

Additionally, relevant records and files in the State Ministry of Agriculture and Natural Resources between December 1989 and October, 1998 were scrutinised for the following information: annual reports on

dog population, reports of epidemic of rabies among dogs and other mammals, action taken, relevant Federal and Local legislations on control of rabies, policy on immunisation of dogs, availability of antirabies vaccine, policy on dog population control and its implementation including destruction of stray dogs, and dog quarantine.

Statistical analysis of data was carried out using Chi-square test with Yates correction for simple proportions; and where figures were small Fishers exact probability test was used (Swinscow, 1983)

Results

Rabies in children

Of the 16 patients with rabies seen in the SHS during the study period, 9 (56%) were children, and of the 3 cases with rabies in UDUTH 2 were children. There were, thus, 11 children with rabies prospectively studied. The clinical data of the paediatric cases of rabies are summarised in Tables I and II. There were 6 males and 5 females (m:f ratio = 1.2:1), aged 3 to 13 years (mean = 7 years; SD \pm 3.1); there was history of dog bite in all cases. All the offending dogs were stray

except in one case (case No. 7; Table I). In case No. 7 the bite was from a dog owned by the patient's father. The dog was killed immediately after the incident. In only 2 patients (cases 4 and 1) was postexposure antirabies vaccination commenced, but never completed. Bites were on multiple sites in 4 (36.4%) cases (including the limbs, head and chest); on the upper limbs alone in 4 (36.4%) cases; and on the lower limbs alone in the remaining 3 (27.2%) cases (see Table I). The incubation period ranged from 1 to 3 months (mean = 1.7 months). Mortality was 100%. Survival after the first symptom was short (range: 3 - 6 days; mean = 3.7; SD \pm 1.0). Duration of stay in hospital was very short (0.5 - 3 days; mean = 1.36 days). The places of abode of the 11 patients is shown in Table I. Only 3 (27.3%) patients came from Sokoto town. Three (27.3%) patients came from Zuru town in Kebbi State (about 200km South of Sokoto); 2 (18.2%) cases from Illela town (60km from Sokoto on the Nigeria - Niger border); 2 (18.2%) patients from Gwadabawa local government area in Sokoto State also a few kilometers from the border with Niger Republic and 1 (9%) case from Niger Republic.

Table I. Clinical Data of 11 Children with rabies seen between December 1999 to October, 1998

Cases No	Age(Years)	Sex	Site of bite	Postexposure Vaccination	Incubation period (mos.)	Survival after 1 st symptom (days)	Duration of stay in hospital days	Town, Local Govt. area, State, where bite occurred
1	6	F	Right buttock	ARV (DE) uncompleted	1.5	6	3	Sokoto town
2	9	M	Right index finger	None	2.0	4	2	Zuru, Kebbi State
3	6	M	Right forearm and left leg	None	2.0	3	1.0	Zuru, Kebbi State
4	4	F	Chest, scalp jaw	ARV (DE) uncompleted	1.0	3	1.5	Sokoto town
5	10	F	Left leg and heel	None	3.0	4	1.0	Sokoto town
*6	3	F	Left forearm	None	2.0	3	1.0	Niger Republic
*7	7	F	Left hand	None	1.0	4	0.5	Zuru, Kebbi State
8	9	M	Scalp, forehead	None	1.0	3	1.0	Illela town, Sokoto State
9	3	M	Left thigh	None	2.5	5	2.0	Illela town, Sokoto State
10	13	M	Left hand	None	2.0	3	1.0	Sabaru village, Gwadabawa L.G., Sokoto State
11	8	M	Left leg	None	1.0	3	1.0	Gwadabawa Sokoto

* The two cases from UDUTH; all others from SHS. ARV = Anti-rabies vaccine. DE = Duck-embryo type.

The presenting clinical signs in the 11 children with rabies are summarised in Table II. Hydrophobia, the pathognomonic symptom and sign of rabies was found in all the 11 cases following a dog bite. Associated signs and symptoms include: anxiety or apprehension in 9 (82%) cases; aggressiveness in 9 (82%) cases; ataxic gait in 2 (18%) cases and paresis of the lower limbs in one (9%) case. The degree of aggressiveness and agitation was variable (see Table II). One 3-year old girl (case No.6; Table II) presented with no anxiety, apprehension or aggressiveness and neurological examination was essentially normal. This patient walked into the ward accompanied by the mother. The diagnosis of rabies was made on the basis of the classical picture of hydrophobia - which was elicited

when a cup of water was given to the child (who developed sudden laryngeal spasm and great fear). Despite this calmness and absence of any nervousness except when given water, and the absence of paresis, this patient died the following day. The manifestations in case No.9 (see Table II) were similar to those in case No. 6, except that case No. 9 had associated gait ataxia. Case No. 1 (see Table II) had paresis of the lower limbs, but developed painful spasms when offered water to drink (hydrophobia), and also manifested anxiety and aggressiveness. These three patients - cases 1, 6, and 9 had neither the classical furious nor the true dumb form of rabies but a mixture of both. The remaining 9 cases could be considered to have the classical furious form of the disease.

Table II. Clinical signs on Admission in 11 Children with Rabies

Case No	Date seen	Age (years)	Sex	Hydrophobia	Anxiety/apprehension	Aggressiveness	Ataxia	paresis
1	Dec 1989	6	F	+	+	+	-	+
2	July 1990	9	M	+	+	+	-	-
3	January '91	6	M	+	+	+	-	-
4	November '92	4	F	+	+	+	+	-
5	August '93	10	F	+	+	+	-	-
*6	March 1994	3	F	+	-	-	-	-
*7	May 1995	7	F	+	-	-	-	-
8	Dec. 1995	9	M	+	+	+	-	-
9	March 1996	3	M	+	-	-	+	-
10	Dec. 1997	13	M	+	+	+	-	-
11	October 1998	8	M	+	+	+	-	-

* The only 2 cases seen in UDUTH. All others were seen in SHS.
+ = Clinical sign present; - = Clinical sign absent.

Treatment in all cases was symptomatic and was aimed at sedating the very aggressive patients (with chlorpromazine, diazepam) and maintenance of fluid balance (I.V. fluids). No attempts were made at sophisticated resuscitative measures, - such as intubation, tracheostomy, general anaesthesia or total parenteral alimentation.

Dog bite injuries in children

Between December 1989 and October 1998, a total of 991 victims of dog bite injuries were reported to the Sokoto State Veterinary Centre (SSVC). Of these (63%) were children below the age of 12 years. Prevalence of dogbite was highest (397 cases; 40%) during the dry, hot season (March to June), and lowest (119 cases, 12%) during the wet season (July to October). Although all the patients were advised to come to either UDUTH or SHS for treatment, only 294 cases of dogbite injuries were recorded in the SHS, of which 192 (65%) cases were children (< 12 years). Of these, 39 (20%) were admitted due to severe injuries

(grade III severity). In UDUTH only 76 cases of dog bite injuries were recorded between January 1991 and October 1998. Of these 50 (66%) were children, 12 (24%) of whom were admitted. Thus, there were 242 paediatric victims of dog bite seen in the two major hospitals (192 from SHS and 50 from UDUTH), of which 51(21%) cases were admitted, and 191 (79%) treated as outpatients.

Age and sex distribution of cases

The age and sex distribution of the paediatric victims of dogbite in the two hospitals is shown in Table III. There were 137 males (56.6%) and 105 females (43.4%). The m:f ratio was 1.3:1. There was not statistically significant difference in the sex distribution of cases ($X^2 = 0.02137$; $df = 2$; $P > 0.05$). The age range was from 3.5 to 11.75 years (mean 8.1; $SD = \pm 2.4$ years). Up to 161 (66.5%) cases were less than 10 years old. The age range - 5 to 9 years predominated with 113 (46.7%) cases ($X^2 = 37.01$; $df = 2$; $P < 0.001$; Table III).

Table III. Age and sex distribution on Paediatric victims of dog bites in 2 major hospitals in Sokoto (1989 – 1998)

Age Group (Yrs.)	Male n (%)	Female n (%)	Total n (%)
Under 5	27 (11.1)	21 (8.7)	48 (19.8)
5 – 9	64 (26.5)	49 (20.2)	113 (46.7)
10 – 12	46 (19)	35 (14.5)	81 (33.5)
Total	137 (56.6)	105 (43.4)	242 (100)

Table IV. Distribution of 208 cases of dogbite in children according to anatomical site of bite and the grade of severity of injury.

Anatomical site of bite	Grade of severity of injury			Total n (%)
	I	II	III	
Head and neck	0	5	16	21 (10)
Upper limbs	9	33	13	55 (26)
Trunk and buttocks	4	25	10	39 (19)
Lower limbs	12	38	12	62 (30)
Multiple sites	0	0	31	31 (15)
Total n (%)	25 (12)	101 (49)	*82 (39)	208 (100)

Anatomical site of bite and the grade of severity of injury

Table IV shows the distribution of 208 cases of dog bite in children according to anatomical site of bite and the grade of severity of injury. Records were incomplete in the remaining 34 cases. The commonest site was the lower limbs - 62 (30%) cases. Injuries of grade 0 severity were not encountered. Injuries of grade II and III severity comprised of 101 (49%) and 82 (39%) cases respectively, i.e. both grades of severity constituted 88% of cases. All the 51 cases admitted had grade III severity (16 out of 21 cases) compared with 19% (12 out of 62 cases) when injuries were on the lower limbs ($X^2 = 15.9$; $df = 1$; $P < 0.001$). Overall, the severity of injury was highly dependent on the anatomical site of bite ($X^2 = 81.073$; $df = 8$; $P < 0.001$; see Table IV).

Anatomical site of bite and the age of victims

Table V shows the distribution of 208 cases of dogbite injuries according to the age of the patients and the anatomical site of bite. Bites on head and neck were commonest in children under the age of 5, in whom these accounted for 12 (29%) of 41 cases; while such bites accounted for only 3 (4.1%) of 72 cases in the age group 10 - 12 years ($P < 0.05$; Fisher's test). In contrast, bites on the lower limbs were more common in children aged 10 years and above - 28 (39%) of 72 cases, than in children under 5 years old - 5 (12%) of 41 cases ($P < 0.05$; Fisher's test). Overall, the anatomical site of bite was significantly dependent on the age of victim ($X^2 = 39.732$; $df = 8$; $P < 0.001$; see Table V).

Table V. Distribution of 208 cases of dogbite in children according to age of the patients and the anatomical site of bite

Age Group (Years)	Anatomical site of bite					Total
	Head and neck	Upper limbs	Trunk and buttocks	Lower limbs	Multiple sites	
Under 5	12	4	8	5	12	41
5 – 9	6	27	21	29	12	95
10 – 12	3	24	10	28	7	72
Total	21	55	39	62	31	208

$\chi^2 = 39.732$; $df = 8$; $P < 0.001$.

Outpatient treatment of dogbite injuries

Of the 191 children with dogbite injuries who received treatment as outpatients, the treatment was both inappropriate and incomplete in 93 (48.7%) cases. Of these, 55 patients received no local wound care of any type, and 23 received no tetanus toxoid.

All the 93 patients received no postexposure antirabies vaccine (ARV), even though the circumstances of the bite and the fate or ownership of the dog were unknown, or the dog was immediately killed without further observation.

In 98 (51.3%) cases the treatment was appropriate but incomplete. In 78 of these patients no postexposure ARV was given because the dogs did not seem to be rabid at the time of the provoked bite, but further follow-up of the patients and observation of the dogs to help decide whether ARV should be started were not recorded. Of the 20 patients in whom postexposure ARV was appropriately commenced (due to suspicion of rabies in the dog, or killed, or its fate unknown), 6 received duck embryo vaccine (DEV), 7 were given inactivated rabies vaccine prepared on Vero cells (Verorab, Wistair rabies strain PM/W1.38, 1503 3M, Pasteur Merieux, Lyon, France) and in 7 cases the type of vaccine was not specified. Only one patient completed the immunisation schedule with verorab vaccine. None of the patients received immune anti-rabies serum, although it was prescribed in 4 cases. None of the 51 patients admitted seemed to have completed the schedule of postexposure ARV commenced.

In only 78 (32%) cases of dog bite was ownership of dog ascertained. There were no records concerning ownership of dog in 79 (33%) cases and in 85 (35%) cases the dogs were recorded as stray. In 61 (25%) cases the dog had bitten one or more persons including the victim, but this information was not available in 181 (75%) cases. Only 17 dogs were said to have received ARV (type not specified). There was no mention of immunization status of the dogs in the remaining 225 cases of dog bite. There were no records to indicate whether any of the 242 victims of dog bite developed rabies subsequently, because of poor follow-up.

Dog population, immunization of dogs, and dog population control.

The dog population in Nigeria according to a 1990 census (RIM, 1992) was 4,543,003 with a density of 4.9 dogs per km^2 . For Sokoto State in the same period, the dog population was 109,484 with a density of 1.068 dogs/ km^2 . For Sokoto town alone the population of dogs was 800 with a density of 14.53 dogs/ km^2 . This shows that Sokoto town has a fairly dense population of dogs (RIM, 1992). In 1990, of the estimated 109,484 dogs in Sokoto State only 1,464 (1.3%) were vaccinated against rabies (both with owners and stray). The number of dogs immunised dropped to 964 (0.88%) by 1993. Records were improperly kept in subsequent years. There were two reported outbreaks of rabies amongst dogs in Zuru town in 1973 and 1982 and appropriate and prompt action taken at the time included elimination of stray dogs, mass immunization of unaffected dogs with owners and dog quarantine. Vaccination of all dogs against rabies is not free anymore and free vaccina-

tion has been, virtually abandoned since 1986. Therefore, all stray dogs are not vaccinated. The cost of vaccinating a dog against rabies rose from ₦ 10.00 in 1989 to ₦ 500.00 in 1998.

Discussion

There have been, hitherto, no comprehensive reports on rabies and dog bite injuries limited to only paediatric cases in Nigeria. Previous Nigerian series on either dog bite injuries (Kale, 1977) or rabies (Boulger and Hardy, 1960; Elegbeleye, 1975; Warrel *et al.*, 1976) were of mixed type consisting of both adults and children, probably because rabies and dog bite injuries are problems affecting all age groups. Nevertheless, there are a number of problems peculiar to children with regards to rabies or dog bite injuries worth highlighting. In our present series on rabies, more than 50% of the patients were children (below 14 years of age). This age distribution of cases is similar to the series by Lindtjorn (1982) in Ethiopia in which 57% of the cases were children below the age 14 years. Similarly, in the series by Kureishi *et al.* (1992). In China there was a significant preponderance of children with rabies, particularly among the 7 - 12 year olds. The mean age of children with rabies in our series was 7 years.

Rabies occurs in two clinical forms: the furious type and the dumb rabies. The furious (or aggressive) form - which is the more common mode of presentation, is characterised by aggressive behaviour and hydrophobia and is thought to occur when the brainstem, limbic system, cranial nerves and higher centres of the brain are affected. The dumb or paralytic rabies is less common, has quieter symptoms and clinical course and is characterised by progressive flaccid paralysis accompanied by pain and paraesthesia, ocular and cranial nerve palsies, sphincter disturbances and respiratory and bulbar paralysis without hydrophobia and is difficult to diagnose and is thought to occur when the medulla, spinal cord and spinal nerves are involved (Warrel, *et al.*; 1976; Lindtjorn, 1982).

Lindtjorn (1982) had described three patients aged 3, 5 and 3 years respectively with a mixed form of rabies in which, although all three presented with hydrophobia, there was no aggressiveness and also one of them presented with paresis in addition to the hydrophobia. Similarly in our present series, 3 children aged 3, 6 and 3 years respectively presented with a

mixed clinical picture - they had neither the classical furious nor the dumb form of the disease. We agree with the conclusion of Lindtjorn (1982) that rabies seems to be a disease with a clinical spectrum ranging from the furious to the dumb form and it seems that this mixed clinical picture is probably more common in children. The dumb form of the disease is said to be encountered after infection by vampire bats or in patients who develop rabies despite antirabies vaccination (Nye *et al.*, 1991). In our present series, the only two patients who received postexposure immunization with antirabies vaccine developed the furious form of rabies.

It is interesting to note that 3 of the 11 patients came from Zuru in Kebbi State, an area where two epidemics amongst dogs were reported to the veterinary authorities. This area is also inhabited by some tribes who use dogs as an edible meat source. Transmission of rabies through contact with the meat of infected dogs and calves has been described (Tariq, 1991; Kureishi *et al.*, 1992). However, all our three patients from Zuru were actually bitten by dogs. It is also important to note that 5 of the 11 patients with rabies resided either very close to the border with Niger Republic or came from that country - an indication that rabies control in Nigeria must include surveillance at our borders, and international co-operation.

A limitation that was obvious in our study was the absence of laboratory confirmation of rabies, since no serological, immunofluorescent or pathological diagnoses were carried out on any of our patients. This state of affairs is not unique to our series, since similar studies on rabies in developing countries (Lindtjorn, 1982; Kureishi *et al.*, 1992) had similar difficulties. The use of such tests are limited in developing countries to a few research centres (Warrel *et al.*, 1976; Kureishi *et al.* 1972; Taiwo *et al.*, 1998). It is also known that the majority of cases of human rabies reported to national and international health agencies are based on clinical diagnosis, using criteria similar to the ones we used in this study (Bogel and Motschwiller, 1986; Kureishi *et al.*, 1992; FAO, 1996).

With regards to dog bite injuries, children constituted the vast majority of the victims in all the three centres studied. The vast majority of the patients (more than 66%) were children less than 10 years old. In the

mixed, large series on dog bites in Ibadan consisting of 2064 adults and children, up to 42.5% were children under ten (Kale, 1977) and in one report dog bite injuries in Liverpool comprising of 136 cases, with age range from less than 4 years to more than 60 years, there was a preponderance of children (41.2% of cases) aged 14 or less. Universally, it seems therefore, that children are more vulnerable to dog bite injuries than adults. In our series moderate (grade II) and severe (grade III) injuries were found in 88% of children with dog bites and more than 70% of injuries on the head and neck were of grade III severity. The severity of injury was highly dependent on the anatomical site in our series, and bites on head and neck were commonest in children under 5. These findings concur with the studies in China (Kureishi *et al*, 1992) and in Australia (Nixon *et al*, 1980) which showed that children between the ages of 3 and 10 are more likely to suffer from severe bites and from facial bites than the older age groups. In the Australian study 37% of 119 children were bitten on face and head, the modal age for this type of injury being 3 years. Our present study has also shown that the anatomical site of bite was significantly dependent on the age of the victim.

These findings are significant with regards to the risk of development of rabies in children following dogbite injuries from a suspected rabid animal. It is known that the age of the victim, the site of bite and the severity of the wound must be taken into consideration, in addition to the state of dogs health, when deciding on postexposure prophylaxis for rabies (Robinson, 1976). With regards to the age of the victim, - the risk of progression to clinical rabies is greater in young children than in adults; bites in densely innervated areas and places close to the central nervous system (e.g. head, neck) are the most dangerous; and with regards to the severity of wound, although rabies has been reported to occur after very mild wound and even licks by rabid animals, in general the more tissue destruction there is and the deeper the wound the more likely is rabies to follow (Robinson, 1976). These factors, therefore make dog bites in children in our environment particularly more dangerous than in adults.

Conclusion and Recommendations

This study has shown that human rabies is still prevalent in our environment and that children are more exposed to dog bite injuries and hence to the dangers of contracting rabies; that in the vast majority of patients treatment given for the dog bite injury was either inappropriate or inadequate for prevention of rabies; that the veterinary enforcement machinery for preventive measures and control of rabies in dogs has virtually collapsed; that effective and fairly safe postexposure prophylactic agents such as the human diploid antirabies vaccine or even the cheaper and almost equally effective verorab vaccine (Nye *et al*, 1991) are scarce and infrequently used; and that rabies occurs not only in Nigeria, but seems to be a problem also in the neighbouring countries such as Niger Republic.

It is recommended, therefore, that doctors must be conversant with the current WHO recommendations on the management of dog bite injuries and postexposure prophylaxis of rabies (WHO, 1984); that existing legislature on dog population control including elimination of all stray dogs and mass immunization of dogs be enforced and sustained; that adequate stocks of antirabies vaccines for both human and animal use be widely available and affordable; that multisectoral and international co-operation be urgently initiated and maintained with regards to control of rabies and continuous surveillance; and that the problem of rabies be studied on a larger scale with a view of assessing the current size of the problem in Nigeria.

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