Dracunculiasis in Cameroon at the threshold of elimination

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Background Dracunculiasis is endemic in Mayo Sava Division in the Far North Province of Cameroon. Transmission occurs during the rainy season with a peak in the months of July and August.

Methods A combination of interventions consisting of active surveillance, social mobilization, health education, distribution of filters, construction of new water sources, chemical treatment of unsafe water sources with temephos, and case containment were applied in Mayo Sava in 1990–1995 by the national Guinea Worm Elimination Programme (GWEP). Dracunculiasis cases were detected by village health workers, confirmed by health outreach teams and reported weekly to the GWEP.

Results A decline in the incidence of dracunculiasis by 98.1% from 778 cases in 1990 to 15 in 1995, and in the number of endemic villages by 92.7% from 82 in 1990 to 6 in 1995 was achieved. The proportion of cases identified ≤24 hours of worm emergence increased from 19% in 1991 to 73.6% in 1993. Over 1500 nylon monofilament filters were distributed yearly to endemic villages lacking safe drinking water sources, while 81 new water sources were constructed (boreholes, wells and dikes), 55% in 1992–1993. The success of GWEP is attributed mainly to: intensive and simultaneous implementation of interventions in highly endemic villages in the first 3 years of the programme, case containment, and cash reward.

Conclusions Cameroon is on the threshold of eliminating dracunculiasis from Mayo Sava but the major remaining obstacle is the ever increasing threat of re-infestation from neighbouring countries.

Keywords Dracunculiasis, mix interventions, elimination, Cameroon

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Dracunculiasis was first documented in Cameroon during the German colonial period in 18981 and later during the First World War in 1914–1916.2 In the post colonial era, in 1974, an endemic focus of the disease was described in the Mandara Mountains of Mayo Sava Division by Issoufa et al.3 This administrative division covers a territory of 2800 km² with a population of 280 000 inhabitants (Figure 1). Mayo Sava Division is found in one of the most arid zones of Cameroon. In 1987, 17.3% of the population of Mayo Sava had access to potable water while the national average was 31%.4 The transmission of dracunculiasis occurs during the 5 months of the rainy season with a peak in July–August. In 1988, B Kollo conducted a nationwide questionnaire survey to determine the distribution of the disease in Cameroon. Sporadic cases were reported in Manyu (South West Province), Mayo Rey (North Province) while 746 cases were diagnosed in 12 highly endemic villages in Mayo Sava.

In June 1990, the Minister of Public Health approved a national action plan for the elimination of dracunculiasis. This plan adopted strategies proposed by Hopkins and Ruiz-Tiben.5 The objective of this paper is to determine the impact of simultaneous implementation of a combination of interventions by the national Guinea Worm Elimination Programme (GWEP) of Cameroon from 1990 to 1995 aimed at eliminating the disease from Cameroon by December 1995; the target for elimination set by the World Health Organization (WHO), and adopted by other agencies and national governments including Cameroon.

Methods

The following strategies were applied in the Mayo Sava focus:

Active surveillance

Two methods of active surveillance were applied: active case detection including case containment during the rainy season6
and division-wide village-by-village case searches conducted at the end of the rainy season in 1990–1993. Each endemic community identified two individuals for training as village health workers (VHW). Initially, VHW received a short formal training course (6 days). Subsequently, a 2-day refresher course was organized every April, at the Mora District Hospital, on the symptoms and signs of dracunculiasis, diagnosis of a worm in the pre-emergent stage, simple topical treatment of ulcers including application of occlusive bandages, daily detection of each case of dracunculiasis in their respective villages, and health education messages. They were provided with ulcer dressing kits and received a monthly allowance of 2000 CFA francs.* Health outreach teams (HOT) consisting of nurses, sanitary technicians, community health animators, and Peace Corps volunteers (PCV) supervised the activities of the VHW: weekly, in villages with incident cases; fortnightly, in villages with one or more cases the previous year, and monthly, in any at risk village where dracunculiasis had ever been reported within two to three previous years. During the village visit, the HOT would, (i) transcribe information of new cases from the village register to a simplified standardized form, (ii) visit and confirm every case with emergent Dracunculus medinensis, (iii) treat cases that had developed secondary infections, and (iv) resupply the VHW with bandages, antiseptics and antibiotic ointment. These visits also served as an opportunity for the HOT to monitor the performance of VHW and offer guidance when needed. Surveillance information was forwarded to the GWEP secretariat where the number of cases by village was compiled every week and used to plan weekly activities.

* From January 1990 to December 1993, 1 $US = 250 CFA francs, after the 50% devaluation of the CFA franc in January 1994, 1 $US = 500 CFA francs.
Social mobilization and health education

Following a knowledge, attitude and practices (KAP) study conducted in 1992 by the National Task Force of the GWEP, with input from the United Nations Children’s Emergency Fund (UNICEF), WHO, Peace Corps Cameroon and the Ministry of Public Health, posters, appropriate messages and a trainer’s manual were produced. Experienced health educators from the Ministry of Public Health, the Ministry of Social Welfare and Women’s Affairs and CARE Cameroon participated in the programme. Aided with coloured flip charts, health educators led discussion groups by age, sex and neighbourhood through a series of proposed topics: symptoms and signs of the disease, incubation period, unprotected water points as sources of contamination, keeping people from entering drinking water sources, ulcer dressing, appropriate use of filters, and the effect of chemical treatment of wells and ponds with temephos.

Distribution of filters

In 1990 and 1993, El du Pont de Nemours & Company and Precision Fabrics Group donated 100-micron mesh monofilament material to the GWEP. Towards the end of the dry season (1990–1995) over 1500 filters were manufactured in Mora. Filters were distributed yearly in endemic or at risk villages that lacked sources of safe drinking water. One filter per household was offered free of charge in 1990–1993, but filters were sold at the cost of 50 francs each in 1994–1995. The HOT demonstrated the proper use and maintenance of filters to villagers. The former also inspected filters and replaced those found torn or damaged by cockroaches. Filters were popular with villagers, some of whom used their filters in brewing sorghum beer. These villagers were persuaded to purchase separate filters for drinking water.

Rural water supply

Since June 1990 potable water supply to endemic villages has been considered a top health priority in Mayo Sava. Hence new draw wells, deep aquifier wells and concrete-lined wells with rims and sloping aprons were constructed and boreholes drilled. Financial support was obtained from CARE Cameroon, the World Bank, the Islamic Development Bank and UNICEF. Preference for construction of new water sources was given to highly endemic villages (>20% incidence rate). Villagers were required to contribute 135 000 francs to a community fund for the maintenance of borehole pumps. Furthermore, in any village where boreholes were introduced, two villagers (including one woman) were trained in simple pump maintenance procedures.

Application of temephos

In at risk villages lacking safe drinking water sources, shallow wells and ponds were identified and mapped by the divisional hydraulic engineer of Mayo Sava and four sanitary technicians. The list of water points was updated as new dracunculiasis cases were detected in villages which had not previously reported any case. Chemical treatment of drinking water sources was authorized by village chiefs. At the beginning of the rainy season, sanitary technicians were trained to apply temephos 500 E correctly and in a timely way at the concentration of one ppm. Every three weeks, temephos was re-applied to water sources by technicians supervised by the hydraulic engineer.

Case containment and cash reward

Case containment was introduced in the Mayo Sava focus in April 1991. A case of dracunculiasis was successfully contained when D. medinensis larvae were prevented from infecting another subject. To contain cases, the VHW, (i) provided simple topical treatment, including application of occlusive bandages within 24 hours of worm emergence, (ii) persuaded patients to stay away from drinking water sources, and (iii) persuaded members of the community to drink water from safe sources or filtered water. While topical treatment by itself did not prevent transmission, it served as an incentive for patients to report to the VHW. It probably kept some patients who did not wish to soil their bandages out of water, and in other cases, the bandages might have prevented a proportion of larvae from reaching the water. With financial support from UNICEF and Global 2000, medicine and bandages in sufficient quantities were made available to the VHW. The stock was replenished by the HOT during their supervision visits to endemic villages.

In 1992, a modest cash reward (1000 francs) was given to dracunculiasis patients who were diagnosed ≤24 hours of worm emergence and confirmed by the HOT. The VHW received half the cash reward for every case detected at this stage. In 1993 and 1994, the value of the cash reward was doubled. Money from filter sales was used in paying the reward in 1994. Moreover, in 1995, Health Development International (HDI) gave a donation of 500 000 francs to GWEP. Due to the fact that only 10 indigenous Cameroonian cases were projected for 1995, the reward was substantially increased to 23 000 francs for any indigenous Cameroonian patient and 3000 francs for every foreign case. The difference was intended to discourage the inflow of foreigners hunting for the reward. Any person who detected/reported a confirmed case received 4000 francs, while the VHW or the health centre staff who treated the case received 10 000 francs. Furthermore, any village that actively participated in implementing case containment earned 40 000 francs.

Results

In 1990 through 1993, division-wide village-to-village case searches were conducted at the end of the transmission season, but in 1994, weekly reports were considered to cover over 95% of cases, thus case searches were no longer cost effective. Table 1 shows the decline by 98.1% in the incidence of dracunculiasis from 778 cases in 1990 to 15 cases in 1995 and the decrease in the number of endemic villages in Mayo Sava Division from 82 in 1990 to 6 in 1995 (92.7%). The HOT arrived

Table 1 Annual incidence of dracunculiasis in endemic and surveyed villages in the Mayo Sava focus in 1988–1995

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<tbody>
<tr>
<td>No. of cases detected</td>
<td>746</td>
<td>871</td>
<td>778</td>
<td>393</td>
<td>159</td>
<td>72</td>
<td>30</td>
<td>15</td>
</tr>
<tr>
<td>No. of villages surveyed</td>
<td>12</td>
<td>16</td>
<td>693</td>
<td>661</td>
<td>474</td>
<td>61</td>
<td>54</td>
<td>29</td>
</tr>
<tr>
<td>No. of endemic villages</td>
<td>11</td>
<td>14</td>
<td>82</td>
<td>80</td>
<td>40</td>
<td>19</td>
<td>18</td>
<td>6</td>
</tr>
</tbody>
</table>

* Mayo Sava division-wide, village-by-village case searches conducted at the end of the rainy (transmission) season.
in endemic villages on appointment day for their weekly visits approximately 90% of the time. They confirmed 80% of cases while the senior supervisors (GS and DM) reconfirmed 20% of dracunculiasis cases. Data from village registers indicated that VHW completed containment activities for 19.1% of cases within 24 hours of worm emergence in 1991, 61% in 1992, 73.6% in 1993 and 70% in 1994. The significant impact of case containment and cash reward on early case detection (≤24 hours of worm emergence) is portrayed in Table 2 ($\chi^2$ for linear trend = 123.58, $P < 0.00000$).

In at risk villages lacking safe drinking water, 89 ponds and swallow wells were chemically treated with temephos in 1990, 74 in 1991, 64 in 1992 and 30 in 1993–1995. The number of treated unsafe drinking water sources declined with the decreasing number of endemic villages as well as with the increasing number of newly constructed water sources. In the months of July and August, roads and paths to endemic villages in the Mandara plain were inundated thus delaying for 5–6 weeks temephos application in 30% of the villages.

In fiscal year 1990–1991, 3 boreholes were drilled and 12 concrete wells were constructed in endemic villages on the plain. In 1991–1992, 6 boreholes were drilled in endemic villages on the plain while 4 aquifer wells were constructed in villages in the mountains. In 1992–1993, 55 new safe water sources were introduced: 14 concrete wells, 6 aquifer wells and 11 dikes in the mountains; 3 aquifer wells and 5 boreholes in villages on mountain slopes, while 16 boreholes were drilled on the plain. Finally in 1995, one water reservoir was built in Kangaleri village. The yield of 6 (20%) of the 30 boreholes was either scanty or nil.

Proper use of nylon filters was reported in 75–80% of households, 10–15% of filters were damaged while the remaining 5% were used for brewing sorghum beer. Owners were persuaded to buy other filters for drinking water.

**Interventions in highly endemic villages**

In 1989, the incidence rate of dracunculiasis in the highly endemic village of Sanda Wadjiri was 49.6% (486/980). This village received 240 cloth filters (nylon filters were not yet available), 26 health education sessions and unsafe drinking water sources were treated with temephos. These simultaneous interventions led to the reduction of the incidence rate of dracunculiasis in 1990 to 17.8% (Figure 2). Four boreholes were drilled in 1990–1991 and the incidence further declined to 5.6% in 1992, to 0.4% in 1993, and since then no case has been reported in Sanda Wadjiri. In 1990, 609 (78.3%) of 778 cases identified in the Mayo Sava focus were reported in the eight

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### Table 2: Impact of case containment and cash reward on early detection of dracunculiasis cases (≤24 hours of worm emergence)

<table>
<thead>
<tr>
<th>Year</th>
<th>≤24 hours</th>
<th>&gt;24 hours</th>
<th>Total</th>
<th>%</th>
</tr>
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<tbody>
<tr>
<td>1991</td>
<td>75</td>
<td>381</td>
<td>396</td>
<td>19.1</td>
</tr>
<tr>
<td>1992</td>
<td>97</td>
<td>62</td>
<td>159</td>
<td>61.0</td>
</tr>
<tr>
<td>1993</td>
<td>53</td>
<td>19</td>
<td>72</td>
<td>73.6</td>
</tr>
<tr>
<td>1994</td>
<td>21</td>
<td>9</td>
<td>30</td>
<td>70.0</td>
</tr>
<tr>
<td>Total</td>
<td>246</td>
<td>408</td>
<td>645</td>
<td>37.6</td>
</tr>
</tbody>
</table>

$\chi^2$ for linear trend = 123.58, $P < 0.00000$.
highly endemic villages. The incidence rate significantly reduced to 23.3% in 1992 and to 0% in 1994 and 1995.

**Threat of re-infestation**

In 1991, 28 (35%) of 80 endemic villages of the Mayo Sava focus were within 15 km of the Nigerian border (Borno State) and 197 (50.1%) of 393 cases were reported here. In 1992, 51 (33.6%) of 159 cases were detected in 16 villages (40%) located in that strip but three of the cases (1.9%) were imported from Borno State. In 1993 and 1994, five cases (6.7%) and eight cases (26.7%) were respectively imported from Borno State and reported to the guinea worm elimination programme of Nigeria (NIGEP) through the WHO. Furthermore, in 1995, six cases (40%) were imported from Borno State while one case (6.7%) came from the Republic of Niger.

In November 1995, six cases of dracunculiasis were reported in the village of Sirlawe (140 population) in the Guidiguis Subdivision in Mayo Kani Division bordering Mayo Kebi Prefecture, Chad (Figure 1). All the patients were adult Cameroonians. The outbreak was investigated by one of us (DM). This village had been free of dracunculiasis until 1993 when one of the villagers (index case) was diagnosed with an emergent worm. In 1992, this man had visited his aunt for one week in the village of Youvat, Mayo Kebi Prefecture. Three people including the index case, his daughter and another man suffered from dracunculiasis in 1994. The two infected men in 1994 were also among the six cases reported in 1995. It has now been established that these cases were a result of local transmission in Sirlawe village.

**Discussion**

Interventions applied in the relatively small dracunculiasis focus of Mayo Sava led to significant reduction of incident cases and the number of endemic villages in 5 years. Intensive, aggressive and simultaneous action in the eight highly endemic villages with 93.3% of cases (813 of 871) in 1989 and 78.3% of cases (609 of 778) in 1990 encouraged those involved in the elimination campaign to apply a mix of strategies.7,9 These results are in agreement with lessons learned from the elimination of dracunculiasis in Pakistan, namely: priority of effort in highly endemic communities, the active participation of the affected community in the elimination endeavour and early implementation of case containment.10

In 1990, at the beginning of application of temephos to water sources by GWEp, villagers complained about the change of colour and taste of treated water. Consequently, some of the drinking water sources were not shown to the HOT. Furthermore, some villagers refused to drink the water because of the belief that temephos killed the 'soul' of the water points, and above all, they were afraid temephos would make the water sources go dry. It was, therefore, of ultimate importance to convince affected communities of the safety of temephos. Temephos alone was shown to have significantly reduced the incidence of dracunculiasis in two villages in Mayo Sava but failed to eliminate the disease (B Kollo and D Agbor-Tabi, unpublished report). However, these authors did not ensure thorough application of temephos to all available drinking water sources. Temephos was reported to have reduced the incidence of dracunculiasis by 67% in Burkina Faso11 but failed to do so in Togo12 and the Republic of Benin.13

Since 1991, case containment has been simultaneously applied with the distribution and monitoring of effective utilization of monofilament filters in endemic villages lacking safe drinking water sources, and chemical treatment of ponds and swallow wells with temephos where applicable. Any uncontained case was a potential source of secondary contamination of unsafe water points. With one human carrier theoretically capable of discharging up to 3 million dracunculid larvae per worm, there was a huge potential for re-infestation of community water supply. Inflective human carriers could re-seed once cleared ponds, and de novo infect 'clean' ponds, hence the likelihood of spreading dracunculiasis whenever water conditions and the cyclops habitat were suitable. In 1992, one case was not contained in Kangaleri village. The following year this index case gave rise to an outbreak of 23 cases accounting for 31.9% of 72 cases. Kangaleri thus became the highly endemic village in Mayo Sava in 1993, as well as in 1994 with 14 cases of 30 (46.7%).

Recent studies have shown that provision of safe drinking water is liable to significantly reduce the incidence of the disease to almost zero in 2 or 3 years.14,15 This was the case in highly endemic villages of Mayo Sava although a mix of interventions was simultaneously applied. However, potable water supply was not in itself sufficient in preventing dracunculiasis transmission when a person, hard at work or in a neighbouring village, took the risk of drinking water from a nearby contaminated pond.16

Inefficient co-ordination of rural water supply in the first 3 years of GWEp was one of the major set backs. Funding agencies exceptionally authorized the drilling of boreholes in Mayo Sava Division even though 56% of dracunculiasis endemic villages were unable to contribute money for pump maintenance. This set a precedence and frustrated non-endemic communities which were obliged to comply with this sine qua non requirement.

In the months of February through May 1995, in Mamfe, Fontem, Pitoa, Rey Boubia, Kaele, Tagoua and Maga where sporadic cases might occur, policy makers, health personnel, radio (national and provincial) and newspaper journalists were educated about the disease: what to do when a case is detected, keeping people with emerging guinea worms from entering sources of drinking water, reporting the case and getting substantial cash rewards. Information disseminated to the general public through regular health programmes in national languages on the provincial radio stations of northern Cameroon, and radio and television programmes in official languages (English and French) led to several rumours of unconfirmed dracunculiasis cases in four of the five divisions of the Far North Province and in Obala (50 km north east of Yaounde). Most importantly, the outbreak of dracunculiasis in Sirlawe village (Guidiguis Subdivision) was reported as a direct consequence of increased awareness of dracunculiasis by health personnel and the general public. The Ministry of Public Health gave specific instructions to administrative and health officers to report immediately by telegram any suspected case of dracunculiasis to the nearest health district. The case had to be confirmed by one of us (DM or OZ) within 72 hours. Hence, when guinea worm elimination programmes institute cash reward when the incidence is significantly low, the quality of surveillance and of case containment is high. Care should be taken to ensure that cash rewards do not lure patients into villages where the disease has been
eliminated due to the risk of their re-infestation, given that the spread of the disease has been associated with population movements. Recently, long-standing civil strife in southern Sudan has favoured the spread of the disease along its border and resulted in the export of *D. medinensis* into Ethiopia, Kenya, Uganda and the Central African Republic. Furthermore, sufficient funds should be made available to pay on time, with corresponding publicity, all those rewarded.

Since Borno State (Nigeria) continued to export cases to Mayo Sava while Mayo Kebi Prefecture (Chad) could potentially export cases to other divisions of northern Cameroon, monthly co-ordination meetings of NIGEP-GWEP/Cameroon, and later the GWEP of Chad and Cameroon, were held regularly to discuss issues pertaining to cross border disease surveillance (number of cases detected, date of diagnosis, any imported cases, their home villages, village of resident at the time of worm emergence), case containment, filter distribution and cash reward. Knowledge of regional dynamics of the disease could therefore be collated and applied in a timely way to secure and accelerate the dracunculiasis elimination process.

**Conclusion**

Cameroon is at the threshold of eliminating dracunculiasis but this will not be achieved as long as incident cases are detected in neighbouring countries.

**Acknowledgements**

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**References**