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MALARIA IN SRI LANKA – THE PAST, THE PRESENT AND THE FUTURE

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Historical overview and past trends

A review of the records on the history of malaria in Sri Lanka indicates that the disease has been present for centuries. A map published by the Dutch in 1683 is considered the earliest record in which the area of the old kingdom of Yala (in the Southern Province) is denoted as an area, which was "depopulated and deserted 300 years ago, by fever sickness". Historians believe that the decline of ancient civilization from the beginning of thirteenth century was due to malaria.[1]

The inauguration of the first Anti-Malaria Campaign in Kurunegala during the year 1911 may be considered as the first organized state intervention towards prevention and control of malaria in the modern era. Measures to prevent vector breeding by environmental manipulation such as filling, draining and 'oiling' of breeding sites as a measure to destroy larvae were the control methods available at the time. Subsequently Anti-Malaria Centres were established at Mahara Prison, Anuradhapura and Trincomalee during the years 1923 and 1924 and in several more places afterwards. [1]

Appointment of the first malariologist in 1921 was followed by implementation of various malaria control measures under his supervision. These measures included introduction of larvivorous fish into breeding sites of the vector and draining or 'oiling' of breeding sites. The importance of malaria control in the estates was emphasized. A malaria control scheme for the estates owned by the Ceylon Estate Proprietary Planters' Association was started in 1926.[1] The estate population comprised an appreciable population during this period.

Malaria control measures during the pre–DDT era (prior to 1945/46) were, in general, confined to larviciding by 'oiling' the breeding sites or application of larvivorous fish to breeding sites. Environmental measures to fill up the breeding sites or to drain out the water in them were also practised. In hyper-endemic malarious areas, quinine distribution was carried out during the period of seasonal rise in malaria.

The devastating malaria epidemic that swept the country in 1934/35 has been the worst recorded malaria epidemic that the country ever experienced. The entire Western and Sabaragamuwa provinces, lower parts of the North Western Province and major parts of Kandy and Matale districts were affected. A population of 3.1 million was living in the area hit by the epidemic. It is reported that 1.5 million contracted the disease and approximately 80,000 died during the 7-month period between October 1934 and April 1935.[1] This epidemic had very important sequelae. The Government commissioned an expert, Colonel C.A. Gills to study the 1934/35 epidemic and the problem of malaria epidemics in the country and to make recommendations with regard to the prevention of future epidemics. The report was followed by the inauguration of the Malaria Control and Health Scheme of 1937.[1]

A major breakthrough that took place in 1945/46 was the introduction of residual spraying with DDT (dichloro-diphenyl-trichloriethane). In fact, Sri Lanka (then Ceylon) was the first country in Asia to start DDT spraying for malaria control on a countrywide basis. The rationale was to drastically reduce the vector density by destroying the vector mosquito, which would rest on surfaces that have been sprayed

with DDT. The formulation sprayed had a long period of residual chemical activity. The local vector exhibited the habit of "endophily", i.e., resting inside dwellings, after taking a blood meal.

The DDT-spraying scheme commenced in November 1945, when two mobile units started functioning in Anuradhapura and Kekirawa. By 1947, the entire dry zone (excepting the North Western portion of Jaffna peninsula), the entire intermediate zone, and parts of the wet zone subject to "epidemic malaria", were being covered by the spraying programme. The spraying units operated either as "Truck Units" each with 9-15 spraymen supervised by a driver-cum-overseer and an overseer, or as "Walking Units" comprising an overseer and 3-4 spraymen. The latter units were employed in urban areas where a vehicle was not required by the unit because the dwellings were close to each other, or in very remote areas in which a vehicle could not be used.

The countrywide DDT-spraying programme resulted in a dramatic reduction in the malaria incidence. Cessation of malaria transmission was seen in the wet zone and in the intermediate zone. Consequently progressive interruption of spraying was carried out during the period 1951 to 1955.[1]

By the early part of 1955, large-scale spraying had been withdrawn. However, emergency spraying units were kept ready, and a surveillance system for the early detection of malaria patients was established. Appearance of insecticide resistance in some malaria vector species in other countries had been reported by this time, urging the necessity to limit spraying only to areas where insecticide spraying was really justified. Only 1,037 malaria patients were reported in 1958, as against 10,442 malaria patients reported in 1957.

The Eighth World Health Assembly held in May 1955, passed a resolution requesting the Governments to intensify their malaria programmes, to enable eradication of the disease before the serious problem of Anopheline vector resistance to insecticide emerged. The malaria *eradication programme* commenced on 2 December 1958, with the ultimate goal of elimination of the parasite reservoir in the country by the end of a 5-year period. The organizational structure comprised the Anti-Malaria Campaign, which would function as a decentralised unit of the Department of Health Services. The malarious areas of the country were divided into four regions, viz. the Northern Region, the Central Region, the Eastern Region, and the Southern Region. Regional Offices were established at Anuradhapura, Kurunegala, Batticaloa and Tangalle respectively.

Under the eradication strategy all dwellings in the endemic areas were placed under a regular spraying programme, using DDT as the insecticide and 390,233 houses were included in this spraying programme; 37 spraying units (comprising 13 Super Jeep units and 24 Jeep units) were employed. The criteria for the interruption of spraying were set as cessation of transmission, infant parasite rate reaching zero, and the annual parasite incidence declining to less than 0.5 per 1000 population.

By 1963 transmission was thought to have been interrupted, with only 17 malaria patients detected during the year. Subsequently the dry zone was placed under the *consolidation phase* in May 1964 by withdrawal of spraying.

The events that ensued during the following years were most unfortunate. Cases increased during the next three years and resulted in a flare-up in 1967 (3,466 cases) when two *P. vivax* foci appeared in Matale and Kurunegala Health Divisions. More

than one million cases were recorded during the epidemic of malaria, which reached a climax during the years 1968, 1969 and 1970. Being preponderantly a *P. vivax* epidemic the mortality during the epidemic was extremely low. Only 125 deaths have been reported during the period 1968-1970, as against a case-load of 1,446,551 reported during the same period. DDT spraying had to be resumed. All areas with malaria-transmission had been placed under spraying by the end of 1968.[2]

A very significant finding made in April 1969 was that vector resistance to DDT had started appearing .[3] Although a substantial reduction in the malaria incidence was observed during the years 1971 and 1972, subsequently an upward trend was seen again, presumably due to spreading DDT resistance in the vector. By 1975, there was a marked increase in *P. falciparum* infection, specially noticed in health areas Bibile and Monaragala. A *crash programme* to contain malaria commenced in March 1975 with the introduction of malathion spraying in the endemic health areas of Bibile and Monaragala and the adjoining parts of the health areas of Balangoda, Atakalampanna and Hambantota. Change of the residual insecticide from DDT to malathion was subsequently carried out in many other health areas, due to the poor impact of DDT spraying caused by increasing levels of vector resistance. Eventually, by July 1976, DDT spraying was completely abandoned.

A very ambitious project, the *Five-year Intensive Malaria Control Programme* commenced in August 1977, with assistance from several bilateral agencies and donor countries. Under the scheme, malathion (at a target dose of 2 g/m^2) was sprayed in approximately one million structures located in the malarious districts, at 3-monthly intervals. Beside this principal strategy of vector control by indoor residual spraying, supplementary methods such as chemical larviciding during dry periods by the use of temephos (Abate), and space-spraying (thermal fogging/ultra low volume spraying) during times of large conglomerations of people during festival times, were also carried out. The surveillance system was strengthened by having *activated passive case detection* posts in a large number of medical institutions.

A marked reduction in the number of malaria patients was observed during the three year period 1978 to 1980, however, following the unusual drought that occurred in 1982 an epidemic that originated in the 'intermediate zone' spread to many parts of the country, reaching its climax in 1984. The incidence decreased in the following years but another major epidemic was experienced during 1987. Large scale residual insecticide spraying and the surveillance activities continued, but the high morbidity from malaria continued.

The first *falciparum* malaria patient showing resistance to chloroquine was detected in 1984 in the village of Wewala in the health area of Dambulla, approximately 22 km from historic Sigiriya. Stringent measures were taken by the Anti-Malaria Campaign to contain the focus of chloroquine-resistant *P. falciparum* malaria, which was quickly identified around the first case detected.

By 1992, there was evidence that the susceptibility level of the vector to malathion was rapidly decreasing in some districts (Records of the AMC 1992). The Anti-Malaria Campaign had already started testing suitable candidate insecticides to replace malathion in case the vector resistance increased to critical levels. In 1994 malathion had to be withdrawn from two districts. In the Kurunegala district malathion was replaced by lambda-cyhalothrin (a synthetic pyrethroid) and in the Puttalam district malathion was replaced by fenitrothion (an organophosphate). These two districts in the North Western Province contributed approximately 30 percent of

the total number of malaria cases detected in Sri Lanka during the year 1992. A dramatic reduction in the malaria incidence in the two districts was seen after the introduction of the alternative insecticides.

Epidemiological considerations

In general, the degree of endemicity of malaria in different parts of the country has been largely determined by the climatic factors, which in tum, influence the vector breeding potential in an area. Three climatic zones are recognized, viz, the 'dry zone, the intermediate zone, and the wet zone. The endemicity in the dry zone is high, whereas it is low in the wet zone. The intermediate zone experiences the 'unstable type' of malaria, with increased transmission during dry weather when 'pooling' is seen in rivers and streams.

Considering the distribution of malaria cases in the country during the last decade, it is observed that the North Western Province and the North Central Province have been contributing the bulk of the total caseload during the first half of the decade. However, during the last years of the decade the Northern and Eastern Provinces have been recording more than half of the total country morbidity. It is reasonable to assume that constraints experienced by the Anti-Malaria Campaign in the conflict-affected Northern and Eastern Provinces caused this change. The Moneragala District too had a high incidence of malaria throughout the last decade.

Adoption of the Global Strategy for Malaria Control

In July 1993 Sri Lanka adopted the *Global Strategy for Malaria Control* recommended by the World Health Organisation in 1992. Accordingly, the following actions were carried out:

1. Early detection and prompt treatment of cases.
2. Selective and sustainable control methods including vector control.
3. Mechanism to forecast and prevent outbreaks / epidemics.
4. Strengthening local capabilities in basic and applied research, to promote better understanding of the determinants of disease, specially ecological, social and economic.

Roll Back Malaria Initiative

The Government of Sri Lanka is now committed to the global Roll Back Malaria Initiative (RBMI) of the WHO which is a social movement drawing its strength by improved health sector development. The operationalization of RBMI is based on six strategies, viz., enhanced diagnosis and treatment, disease transmission control, enhanced surveillance, health sector development, community mobilization, and advocacy. The districts of Jaffna, Killinochchi, Mullativu, Anuradhapura and Moneragala have been chosen for piloting of RBMI.

Actions for the future

The two formidable technical problems of increasing drug resistance in the malaria parasite and insecticide resistance in the malaria vector seem major obstacles for malaria eradication in tropical countries including Sri Lanka. However, elimination of malaria mortality and prevention of severe malaria, along with a very effective degree of transmission control should be attainable objectives by the judicious use of available malaria control methods.

Maximum efforts need to be taken to prevent the emergence of multi-drug resistant strains of *P. falciparum* malaria. Application of biological methods of vector control, viz., larvivorous fish, *Bacillus thuringiensis* and growth hormone regulators have already been introduced in an attempt to reduce insecticide pressure and thereby prolong the usefulness of insecticides presently effective against the vector.

Rapid diagnostic tests for diagnosis of malaria have been introduced, specially to cover complex and emergency situations.

Participation of the community in malaria control activities is to be enhanced, specially in activities such as implementation of community based bed net programme.

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