



The Galle Medical Journal

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Editorial

To look back and reflect

Looking back and reflecting helps to understand affairs in a correct perspective. It also helps to audit and reform one's practices. Reflection has many hues of meaning and nuances. Two papers of this issue look back and reflect on two different areas - medical behaviour and medical history.

Effective communication forms a key foundational element of clinical practice and research. Communication occurs at many levels, via different media and it is multi-directional. It occurs between doctors and patients and their families and between co-workers and workers of different levels. Often communication is done through spoken word but it is done in writing or through electronic means. Most conflicts, misunderstandings, mismanagements and medical litigation stems from defective and non-effective communication. In his leading article, Ariyananda *looks back and reflects* on professional behaviour - gaps in communication skills of doctors. We need to effectively communicate at all times to be 'good' doctors, academics and researchers.

Hewa *looks back and reflects* on a facet of medical history of Sri Lanka in his review article on tropical disease and imperial medicine in colonial Sri Lanka (or Ceylon as it was then known). He gives an excellent vista of medical care of that time with period photographs and comment. He further opines that cultural imperialism was at the heart of the Western colonizing project around the globe and that economic and health policies were the twin pillars that sustained the material and cultural dominance over indigenous populations.


Satish K Goonesinghe
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Editors in Chief/ GMJ

Gaps in communication skills of doctors

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“I went to see a doctor for my backache, the doctor spoke only few words and prescribed few medicines to be collected from the pharmacy. I wanted to say more about my illness, but I did not get a chance as the doctor was in a hurry.”

This is a familiar story. There are many things that patients would like to happen when they see a doctor. It is clear in the foregoing narration that this doctor-patient encounter fell far short of the expectations of the patient. Let us reflect why patients perceive that some consultations are far short of their expectations and whether such expectations are rational.

‘Tomorrow’s Doctors’ published by the United Kingdom General Medical Council spells out competency level of communication skills required by a doctor as: “Doctors are expected to; communicate clearly, sensitively and effectively with patients, their relatives or other care givers, and colleagues from the medical and other professions, by listening, sharing and responding; communicate clearly, sensitively and effectively with individuals and groups regardless of their age, social, cultural or ethnic background” (1).

What communication skills should a doctor possess?

Spoken skills: Doctors are expected to possess generic communication skills such as speaking skills, writing skills, listening skills and non-verbal communication skills. Doctors are expected to use these skills during their interactions with patients and caregivers, and also when they interact with members of the healthcare team. During doctor-patient interactions, communications should be done with empathy and compassion. In addition to data

gathering that takes place during history taking, three other important processes take place and they include rapport building, information sharing (including patient education) and counselling. It is known that hospital specialists give more emphasis to data gathering, whereas latter three aspects of history-taking are carried out better by general practitioners, psychologists, psychiatrists and palliative care physicians. During data gathering, more closed-ended questions are used, compared to open-ended questions that are used more frequently during information sharing and rapport building. During data gathering what one records is mainly biomedical data to find out about the disease (disease-centered approach) as opposed to inquiring about perspectives to find out about suffering (illness-centered approach) (2). As neither of these approaches alone are adequate, it is important for doctors to strike a balance between ‘disease-centered’ approach and ‘illness-centered’ approach with a ‘patient-centered’ approach. ‘Patient-centered model’ is a hybrid of the ‘disease-illness model’ that was used earlier, which had two segments namely ‘disease framework’ or ‘doctor’s agenda’ and ‘illness framework’ or ‘patient’s agenda’. The ‘patient-centered’ approach is more likely to address holistic care. Therefore, doctors should take a ‘patient-centered’ approach when engaging in history taking as it gives a balanced interaction (3). This requires fluency in the appropriate use of ‘open ended and closed questions’, attentive listening, and clarification of contents of the discussion as and when necessary, rephrasing questions, summarizing the conversations on and off as the consultation proceeds, and interpretation of verbal and non-verbal behavior. Such close interactions seem to develop a therapeutic relationship (4). It is important for doctors to learn

and practice the art of 'cue recognition', which may be expressed verbally and non-verbally. They should also learn how to respond to patients' emotions, be it negative or positive. Often emotions are expressed non-verbally. These skills are very useful in special situations like 'breaking bad news'. In the approach recommended by Neighbour in 1987, he mentions five aspects - connecting, summarizing, handing-over, safety-netting and housekeeping - that needs addressing (5). In addition to the approach mentioned above, other well-known methods of doctor-patient communications include: i) *Calgary-Cambridge Model* which has a structured questionnaire with about 70 questions that are clustered into subdivisions such as initiating the session, gathering information, building relationship, explanation about the illness and management plan, and closure (6); ii) *'Three-function approach'* with subdivisions including data gathering, rapport building and supporting patient's emotions, and counselling or education of patients regarding their illness (7); iii) *'E4 Model'* which includes engaging (engage with the patient), empathizing (empathize with the patient), educating (educate the patient) and enlisting (involve the patient in decision making and adhering to treatment) (8), and iv) *'Four-habits Model'* of Franken and Stein which includes investing in the beginning, eliciting the patient's perspective, demonstrating empathy and investing in the end (9).

There are things that doctors need to consciously avoid to prevent breakdown in communication. These include getting distracted by other activities, avoiding eye contact, having a blank stare, reading the computer screen / smart phone, or allowing frequent interruptions such as telephone calls and nurses' questions. Doctors should not write and listen at the same time. It can lead to loss of information, both verbally or non-verbally. When listening and questioning, doctors should look at the patient at the same eye level as the patient. Looking down at a patient from a higher point gives the impression of the doctor being dominant with minimal or no empathy and suppressing a patient's attempts to carry out a conversation.

There are techniques which could facilitate clinical communication such as asking *'Is there anything else you would like to talk about?'* or

sharing the doctor's own life experiences, which may help the patient's well-being. Patients always have questions to ask the doctor, but many doctors do not give them a chance as noted in the narration given at the outset. Doctors should always inquire from patients about their ideas, concerns and expectations. Educating the patient and any personal caregiver is important as it facilitates the management and improves the outcome. Therefore, doctors should make it a habit to tell the patient about the diagnosis, aetiology, treatment, prognosis and functional consequences (impact on life) as far as possible in lay language. Doctors should always verify whether the patient has understood what has been told, as understanding increases the compliance to treatment.

Additional spoken skills of doctors are required when carrying out telephone conversations. Seeking advice from superiors regarding patient management (including emergency care), arranging urgent investigations, arranging special aspects to treatment such as rehabilitation and arranging urgent patient transfers are some instances where doctors have to engage in *telephone conversations*. This is an important communication skill as telephone conversations involve delivering and receiving essential information in a clear, structured format, succinctly and courteously within a short time. The person delivering the information must ensure that the listener has fully understood what is being conveyed. The person receiving the information must listen attentively to the person at the other end of the telephone line, understand what is being conveyed and react appropriately and courteously. In case of doubt, clarifications should be sought. Doctors should seek advice from their superiors or from doctors in the appropriate specialty, as and when needed. Amongst doctors in Sri Lanka, there is plenty of room for improvement of these skills.

Written skills: Written communications are important for the safe practice of medicine. In Sri Lanka, doctors write down their clinical notes in English mainly in formats such as histories, follow-up notes, operation notes, diagnosis cards and referral letters. These documentations need to be precise but adequate (without unacceptable abbreviations), clear, accurate and timely. Often doctors in Sri Lanka fail to meet this requirement

which is evident in consultation notes written by specialist doctors when engaging in private practice. This practice leads to bad role modelling. Similar poor quality writings are commonly seen in state hospitals as well.

Communication skills to handle special situations: There are several situations where doctors have to exercise special skills in communication to be effective such as when: i) interacting with patients with regards to risk and uncertainty, ii) responding to patients' emotions, iii) breaking bad news, iv) facilitating behaviour change through motivational interviewing, v) responding to medical errors and complaints, vi) handling mental health matters, vii) dealing with elderly patients, and viii) dealing with end of life issues. Doctors need special training to handle these situations effectively and sensitively, taking cultural and social contexts as well as role of the family into consideration.

Concluding remarks

Research has shown that when physicians consult a doctor for their own illnesses, they prefer their doctors to have at least the following two qualities. First, the physician providing care should be technically excellent; second, he or she should be empathic and humane (8). All doctors should treat their patients in the same way they themselves want to be treated.

References

1. General Medical Council, Outcomes for graduates (Tomorrow's Doctors), 2015. Retrieved from https://www.gmc-uk.org/-/media/documents/outcomes-for-graduates-jul-15-1216_pdf-61408029.pdf
2. Engel, G., The need for a new medical model: A challenge for biomedicine. *Science*, 1977; **196**: 129-136.
3. Stewart M, Brown J, Boon H, Galajda J, Meredith L, Sangster M. Evidence on patient- doctor communication. *Cancer Prevention and Control*, 1999; **3**: 25-30.
4. Ackerman SJ, Hilsenroth MJ, A review of therapist characteristics and techniques positively impacting the therapeutic alliance. *Clinical Psychology Review*, 2003; **23**(1), 1-33.
5. Neighbour R. The inner consultation. 2nd edn. Oxford: Radcliffe Publishing; 2004.
6. Kurtz SM, Silverman JD, Draper J Teaching and Learning Communication Skills in Medicine. Radcliffe Medical Press (Oxford); 1998.
7. Cohen Cole, S. The Medical Interview: The Three Function Approach. Mosby Year Book, St. Louis. 1991.
8. Keller VF & Carroll JG, A new model for physician - patient communication. *Patient Education and Counselling*, 1994; **23**: 131-140.
9. Frankel RM, Stein T, Getting the most out of the clinical encounter: the four habits model. *J Med Pract Manage*, 2001; **16**: 184-91.

Non-communicable disease burden and quality of life of selected group of older people in Galle, Sri Lanka


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ABSTRACT

Introduction: Chronic ill health due to non-communicable diseases have already posed a great threat to the well-being of older people in Sri Lanka impairing their quality of life to a greater extent. This study was aimed to examine the impact of some chronic disease conditions on quality of life (QOL) of older people in Galle, Sri Lanka.

Methods: This cross-sectional study was conducted in 70 older people (male=21, female=49) aged ≥ 60 years. Validated self-reported version of World Health Organization Quality of Life-BREF (WHOQOL-BREF) questionnaire which measures QOL in four dimensions; physical, psychological, environmental and social was used to assess the QOL.

Results: The age range of the participants was 60-90 years (mean = 70.3 years, SD = 6.2 years). Of the total, 41 subjects were living with their spouse and 22 were widowed. Visual impairment (67%), hypertension (47%) and arthritis (34%) were the most prevalent chronic diseases reported. QOL mean scores for all the four domains which measured in a 1 - 100 scale were all higher than 65 for both men and women. Further, mean scores of QOL in all the domains in both sexes were found to be low among those who were suffering from chronic conditions, although significant differences were found in physical and psychological domains between those with and without cardiovascular diseases and hypertension ($p < 0.1$).

Conclusions: QOL of older people in Galle is relatively higher compared to the QOL of community dwelling older people in many other countries. Although NCDs and other chronic conditions are prevalent in this study population, cultural and environmental factors may have contributed to improve the QOL of this population group.

Key words: Older people, NCDs, quality of life, Sri Lanka

Introduction

The rapid aging of the population in Sri Lanka poses a challenge for well-being of its people and economic development of the country (1-3). The transition from high to low levels of birth and death rates seen in the country over the last few decades is the main reason for these observed trends in the population structure of the country. At present, the

proportion of the population aged 60 years or older in the country is about 12.5%, and in 2031 the figure is expected to increase to 20.7% (4, 5). In 2012, old age dependency ratio was 20.1% and in 2031 the figure is expected to rise to 58.3%. Non-communicable diseases (NCDs) are the main cause of deaths in older people. Conditions like Alzheimer's diseases and other cognitive impairments and disabilities are

also prevalent in older people (3, 6). In 2016, 52.8% of men and 52.1% of women aged 60 years and above were suffering from heart diseases, while 43.8% of older men and 48.6% of older women were suffering from diabetes in Sri Lanka (7,8). Vision and hearing impairments are also common among older people that contributes to the morbidity giving rise to low quality of life (QOL) (7, 9). Social security systems and other financial benefits available for older people living today in Sri Lanka is grossly inadequate to meet expenses related to their NCD health care (3, 10). Thus, the burden of NCDs and other chronic health conditions in older people will become a significant challenge to health care system in the country in the near future (4-7).

These demographic transitions and trends in the prevalence of chronic diseases would eventually determine the living conditions and QOL of this group of people. Thus, one of the greatest challenges Sri Lanka has to face in the 21st century will be to provide care for the older people with poor socioeconomic status and high prevalence of chronic comorbidities. Population dynamics and epidemiological transitions observed over the last few decades have made health care professionals and policy makers more concerned about the QOL of older people since it is directly associated with health care cost. Therefore, it is imperative to identify QOL of older people in different population segments in the country to plan and implement effective, culture sensitive and sustainable health promotion strategies to lessen health and economic burden related to aging of the population in Sri Lanka.

The World Health Organization has defined QOL as the individual's perception of their position in life in the context of the culture and the value system they inhabit, in relation to expectancies, patterns and concerns (11,12). The WHOQOL-BREF is a measurement tool developed by the WHO quality of life group to measure QOL of older people (12). This tool provides scores in 4 domains of QOL; physical, psychological, environment and social. However, there are no worldwide accepted cut-off points in this tool to demonstrate better or worse QOL. The aim of this study was to study the QOL of a selected group of older people in Galle by gender and by some selected chronic diseases prevalent in this population segment.

Methods

A cross-sectional study was conducted in a total of 70 older people, aged 60 years and over recruited for the survey. The Ethics committee at the Faculty of Medicine, Galle approved the protocol of the study. Subjects were selected from two rural and to urban communities in Galle assuming that there is a difference in QOL of older people living in these two community settings. Sample size was determined considering 95% confidence level, and expected standard deviation as $SD = 14.5$ with margin of error of 5. So a minimum of 35 older people were needed for the survey. Data of a total of 70 older people were collected through face-to-face interview and analysed. Subjects of both genders, apparently healthy, independent, mobile, and who were able to communicate verbally were defined as inclusion criteria. Individuals who refused to participate in the survey due to cognitive or other communication problems were excluded.

The World Health Organization Quality of Life-BREF (WHOQOL-BREF) questionnaire that has been validated in Sri Lanka (13) was used to determine the QOL in the target group. The questionnaire consisted of 26 questions. The tool has four domains of health including physical, psychological, environmental and social. Physical health domain were evaluated through seven indicators including pain, dependence on medical aids, energy, mobility, sleep and rest, activities of daily living, and work capacity measure. Psychological health was assessed with six items including positive feeling, personal belief, concentration, bodily image, self-esteem, and negative feeling. Environmental health with eight items deals with issues related to security, physical environment and financial support, accessibility of information, leisure activity, home environment, health, and transportation. Regarding social health, three items were assessed that focused on personal relationships, social support, and sexual life. Domain scores are scaled in a positive direction; higher scores denote higher QOL. All scores are transformed to reflect a scale of 4-20. The second transformation method converts domain scores to a 0 - 100 scale. There was no overall score for the WHOQOL-BREF and each domain was calculated by summation of their specific items. Statistical Package for Social Sciences (SPSS) (version 20.0,

Chicago, IL, USA) was used for statistical analysis of the data.

Results

A total of 70 older people (21 men and 49 women) were surveyed. The age range was 60 - 90 years (Mean = 70.3 years, *SD* = 6.2 years). Of the total, 41 subjects were living with spouse and 22 were widowed. Seven participants were unmarried. Two participants had never attended school and 7 had studied only up to primary education and the rest of the subjects had studied up to secondary or higher education.

The most prevalent chronic diseases reported by the participants were visual impairment ($n = 47$, 67%), hypertension ($n = 33$, 47%) and arthritis ($n = 24$, 34%). Of the total, 2 subjects did not report any chronic health conditions, 4 subjects reported having one chronic health condition and the rest reported having multiple co-morbidities.

Mean and standard deviation scores of the four domains of the QOL in both men and women irrespective of their health conditions are given in table 1. No gender differences were observed in the mean scores of each of the four domains of QOL investigated.

Table 1: Mean and SD of the scores of four domains of the WHOQOL-BREF in both older men and women

Gender		Physical Health	Psychological Health	Environmental Health	Social Relationships
Male	Mean	70.4	74.6	69.2	65.5
	SD	13.2	12.1	10.2	17.5
Female	Mean	68.5	72.6	68.8	68.4
	SD	14.3	13.6	13.1	20.6

Table 2: Mean and SD of the mean scores of the four domains of the WHOQOL-BREF by disease category

Disease Category		Physical Health (Mean, SD)	Psychological Health (Mean, SD)	Environmental Health (Mean, SD)	Social Health (Mean, SD)
Diabetes	Present (n=15)	65.2 (16.6)	68.3 (15.3)	65.2 (12.4)	65.0 (16.7)
	Absent (n=55)	70.1 (13.1)	74.5 (12.6)	70.0 (12.1)	68.2 (20.5)
Cardiovascular diseases	Present (n=13)	58.5 (12.9)*	66.9 (15.9)*	65.1 (12.8)	63.6 (16.5)
	Absent (n=57)	71.5 (13.1)	74.6 (12.4)	69.8 (12.1)	68.4 (20.4)
Hypertension	Present (n=33)	65.4 (12.9)*	71.2 (14.0)	71.2 (11.7)	69.9 (17.1)
	Absent (n=37)	72.3 (14.1)	75.0 (12.6)	66.9 (12.4)	65.3 (21.7)
Asthma	Present (n=8)	70.1 (8.9)	78.1 (9.8)	69.5 (9.2)	57.3 (25.7)
	Absent (n=62)	68.9 (14.4)	72.6 (13.6)	68.9 (12.5)	68.8 (18.6)
Arthritis	Present (n=24)	66.6 (14.8)	72.9 (14.9)	67.5 (12.3)	70.8 (19.2)
	Absent (n=46)	70.3 (13.4)	73.3 (12.5)	69.7 (12.2)	65.7 (19.9)
Visual problems	Present (n=47)	68.2 (13.6)	73.1 (12.7)	68.8 (11.2)	68.4 (17.2)
	Absent (n=23)	70.9 (14.4)	73.3 (14.7)	69.2 (14.2)	65.5 (24.2)
Hearing problems	Present (n=8)	61.1 (13.8)*	74.4 (13.4)	69.9 (15.1)	73.9 (22.4)
	Absent (n=62)	70.1 (13.7)	73.1 (13.4)	68.8 (11.9)	66.6 (19.3)

* Significant difference of the mean values were observed ($p < 0.1$)

Over all QOL scores were seem to be low among those who were suffering from chronic conditions (table 2). However, significant differences in physical health scores were found only between those with and without cardiovascular diseases, between those with and without hypertension and between those with and without hearing problems ($p < 0.1$). A significant difference in psychological health scores were found between those with and without cardiovascular diseases ($p < 0.1$). In social health domain, however, the mean scores were slightly higher in participants with arthritis, vision and hearing problems compared to others, though no significant differences were found. In this analysis we have not analysed data separately for those with multiple chronic conditions and for those with out chronic conditions as sample sizes were too small.

Discussion

Population aging has become a vital public health issue in Sri Lanka. Many health, social and economic implications have been identified with the increasing older population in the country. There is an urgent need to understand factors related to such implications and to formulate health promotion strategies to face future public health challenges of aging population (9, 14). In the field of public health, QOL among older people is an important area of concern (6, 14). The epidemiological transition and increase in the burden of chronic conditions that cause morbidity in old age which is driven by population ageing, would eventually affect the QOL of older people. Thus, it is important to investigate the QOL experienced by older people and its associated factors so that effective health promotion strategies can be formulated and implemented to improve the QOL in this vulnerable group of people.

The QOL of older people investigated in this study was somewhat higher than that of figures found in studies conducted in many other countries. A study conducted on older people in India reported the mean scores of physical, psychological, environmental and social dimensions of QOL as 55.2 (SD = 12.5), 54.6 (SD = 11.9), 52.5 (SD = 12.1) and 36.7 (SD = 16.4) respectively (16). A study conducted in Indonesia using a sample of 88 older people found that the QOL mean scores were lower than 60 for all the four domains of QOL; physical, psychological,

social, and environmental (17). Sri Lankan culture which considers older people as a vital human resource in community well-being, and active life style of the majority of older people as a result of Sri Lanka being an agricultural society may have contributed to this observed higher QOL of older people in Sri Lanka (2, 3, 15).

The effect of any chronic ill health condition was quite significant on QOL of older people. The World Health Assembly adopted the Framework Convention on Tobacco Control and the Global Strategy on Diet, Physical Activity and Health in 2004 (3, 6, 12) and based on that later the 2008-2013 Action Plan for the Global Strategy for the Prevention and Control of Non-communicable Diseases was developed to control global burden of cardiovascular diseases, chronic respiratory diseases, and diabetes specifically prevalent in adults and older people. These chronic disease conditions make a large contribution to mortality in many low and middle-income countries across the world. NCDs are now accounted for 85 percent of the disease burden globally, and in Sri Lanka, non-communicable diseases have become one of the leading causes of morbidity, mortality, disability and hospitalisation among the older population (3, 18).

The prevalence of visual problems (67%), hypertension (47%), arthritis (34%), diabetes (21%) and cardiovascular diseases (19%) were comparatively higher in this target group. The figures were somewhat comparable to such figures found in other countries. For example, a study conducted in India on a sample of 300 older people found that 42.3% had hypertension, 30.7% had impaired vision and 25.3% had diabetes (16).

In our study, physical health domain of QOL was negatively affected by the presence of cardiovascular disease conditions, hypertension and hearing problems and psychological health domain was negatively affected by the presence of cardiovascular disease conditions. Other domains of QOL were not affected by chronic conditions studied in this study. However, it should be noted here that a large scale survey is needed to investigate how chronic health conditions affect QOL of older people and to confirm our results. The psychological well-being of this sample of older people could suggest a

psychological adaptation process. A study conducted in Malaysia showed religiosity as a moderating factor in improving psychological health in older people with NCDs (19) which could also explain the better psychological health found among the subjects in this study. Social contacts and perceived social support from family members and friends are important for fulfillment of different social needs of older people. Social support has been found to be predictive of functional ability levels as well as hospital admission rates (18, 20). In our study social aspects of QOL seems to be satisfactory and efforts should be taken to maintain this existing conditions of social well-being in older people.

Aiming at reducing the risk of non-communicable diseases in 40–65 year olds, by detecting risk factors early and improving access to specialized care for those with a higher risk of cardiovascular disease, the Ministry of Health initiated Healthy Lifestyle Centres in 2011 (2, 3). In addition, there are other public health programs at the community level on prevention of disease and promotion of health for the elderly, such as the national Vision 2020 community programme for eye care and cataract surgery. New strategies considering the changing nature of health care and population dynamics are needed to enhance QOL of older people suffering from NCDs and other chronic ill health conditions.

In conclusion, the QOL of a group of older people in Galle, investigated in this study is praiseworthy. Although NCDs are becoming more and more prevalent in older people, QOL of this target group can be improved using available resources. Promotion of active life styles and social interactions would most probably make older people happy and content irrespective of their health conditions. Globalization, industrialization, migration and competition have created a gap between older people and the rest of the people in the society. Health and education policy makers should consider these issues in formulation of policies to bridge this gap and to promote health of older people with chronic ill health.

References

1. Samaraweera DN. Care of the elderly: a multidisciplinary approach. *Journal of the Ceylon College of Physicians*, 2014, **45**: 45-8.
2. Samaraweera D and Maduwage S. Meeting the current and future health care needs of Sri Lanka's aging population. *WHO South-East Asia Journal of Public Health*, 2019; **5** (2), 96-101.
3. Perera SJ. Ageing Population of Sri Lanka: Emerging issues, needs and policy implications United Nations Population Fund, Colombo, Sri Lanka, 2017.
4. De Silva WI. How serious is aging in Sri Lanka and what can be done about it? *Asia-Pacific Population Journal*, 1994; **9** (1), 19-36.
5. De Silva, WI. A Population Projection of Sri Lanka for the New Millennium, 2001-2101: Trends and Implications. Colombo: Institute for Health Policy, 2007.
6. Michael Engelgau, Kyoko Okamoto, Kumari Vinodhani Navaratne and Sundararajan Gopalan Prevention and Control of Selected NCDs in Sri Lanka: Policy Options and Actions, Paper prepared for World Bank, Washington, DC, USA, October 2010.
7. Department of Census and Statistics. Sri Lanka Demographic and Health Survey 2016, Ministry of Health, Nutrition and Indigenous Medicine, Colombo, Sri Lanka, September 2017.
8. Wijewardene K, Mohideen MR, Mendis S, Fernando DS, Kulathilaka T, Weerasekara D, Uluwitta P. Prevalence of Hypertension, Diabetes and Obesity: Baseline Findings of a Population-based Survey in Four Provinces in Sri Lanka. *Ceylon Medical Journal*, 2005; **50**(2): 62-70.
9. Samaraweera D, Maduwage S. Meeting the current and future health-care needs of Sri Lanka's ageing population *WHO South-East Asia Journal of Public Health*, 2016; **5**(2): 96- 101.
10. Perera B. Social support and social security issues of elders in Sri Lanka. *Galle Medical Journal*, 2011; **16**(2): 20-3.
11. De Silva RE, Perera MSA. Quality of Life in Older Adults Attending a University Family Practice Centre in Sri Lanka. *Journal of Frailty and Aging*, 2018; **7**(2):134-7.
12. World Health Organization Quality of Life Group. The World Health Organization Quality of Life assessment (WHOQOL): position paper from the World Health Organization. *Social Science and Medicine*, 1995; **41** (10):1403-9.
13. Kumarapeli K, Seneviratne R, Wijeyaratne C. Validation of WHOQOL-BREF to measure quality of life among women with polycystic ovary syndrome (PCOS). *Journal of College of Community Physicians of Sri Lanka* 2006; **11**: 1-10.


14. Maduwage S. Sri Lankan 'silver-aged' population. *Journal of the College of Community Physicians of Sri Lanka*, 2019, **25**(1): 1-3.
15. Siddhisena KAP, Degraff DS. A Pace of Its Own: The Demography of Aging in Sri Lanka. *Journal of Population Ageing* 2009; **2**: 77-99.
16. Ganesh Kumar S, Majumdar A, Pavithra G. Quality of Life (QOL) and Its Associated Factors Using WHOQOL-BREF Among Elderly in Urban Puducherry, *India Journal of Clinical and Diagnostic Research* 2014; **8**(1): 54-7.
17. Hidayati AR, Gondodiputro S, Rahmiati L. Elderly Profile of Quality of Life Using WHOQOL-BREF Indonesian Version: A Community-Dwelling, *Althea Medical Journal*, 2018; **5**(2):105-10.
18. Abeykoon ATPL. Aging and the health sector in Sri Lanka, *Ceylon Medical Journal*, 2000; **45**: 52-4.
19. Sazlina SG, Zaiton A, Norafiah AZ, Hayati KS. Predictors of health related quality of life in older people with non-communicable diseases attending three primary care clinics in Malaysia. *The Journal of Nutrition Health and Aging*, May 2012, DOI: 10.1007/s12603-012-0038-8.
20. Kwan P, Ali A, Deuri SP. Psychiatric morbidity, quality of life, and perceived social support among elderly population: a community-based study. *Open J Psychiatry Allied Sci*, 2016; **7**: 31 5.

Screening for Glucose-6-Phosphate Dehydrogenase deficiency using quantitative analysis of G6PD activity: A pilot study to expand the newborn screening panel in Sri Lanka

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ABSTRACT

Introduction: Glucose-6-phosphate dehydrogenase (G6PD) deficiency affects over 400 million individuals worldwide and commonly found in Asia and in the Mediterranean region. This study was aimed to assess the feasibility of incorporating G6PD screening to the existing newborn screening panel in Sri Lanka.

Methods: Dried blood spot samples (n=8795) received during a period of two months consecutively were subjected to the initial analysis and the G6PD activity was calculated by a quantitative analysis of comparing the sample to the control with a known activity using the haemoglobin normalization method. All babies with G6PD residual activity < 2.5 U/gHb were recalled (n=215) for a second sample after 6 months and analyzed using the same assay protocol in order to validate the assay

Results: Analysis of second samples revealed that 58 babies (36 males and 22 females) continued to have < 2.5 U/g Hb activity. The incidence of G6PD deficiency in this selected population was 1 in 155. Range of the measured G6PD activity was 0.5 – 13.8 U/g Hb. Inter assay variation was 2.7% (13.81 U/gHb). Hambantota and Matara districts of the Southern province, which were previously known as malaria endemic areas, reported a higher prevalence.

Conclusions: The incidence of G6PD deficiency is reported for the first time among neonates in Sri Lanka. However, the cut-offs we have defined at 6 months may be at a disadvantage with high attrition, but it saves the cost of additional genetic analysis.

Key words: Newborn screening, glucose-6-phosphate dehydrogenase (G6PD), enzyme activity, dried blood spot, haemoglobin normalization

Introduction

Newborn screening (NBS) is the largest genetic testing effort and is considered as one of the ten great public health achievements during the first 10 years of the 21st century (1). Tests used in NBS are designed to detect asymptomatic newborns at risk of a disease from those who are not at risk. Effective screening of newborns, combined with follow-up confirmatory diagnostic testing and treatment, helps prevent morbidity and mortality (2).

Glucose-6-Phosphate-Dehydrogenase (G6PD) is an important enzyme in the hexose monophosphate oxidative pathway where it plays an essential role in reducing nicotinamide adenine dinucleotide phosphate (NADP⁺) to NADPH⁺. NADPH⁺ protects red cells from oxidative damage. In a reaction catalyzed by G6PD, electrons generated by the conversion of glucose-6-phosphate to 6-phosphogluconate are transferred to NADP⁺ (3). G6PD deficiency can lead to an increased risk and

earlier onset of neonatal hyperbilirubinaemia or may present later in life with acute haemolytic crises. Intermittent exacerbations of acute intravascular haemolysis occur after exposure to certain drugs like antimalarial or sulfonamides, food stuffs like fava beans, or with infections such as viral respiratory infections, hepatitis, and bacterial pneumonia (4). In certain populations, hyperbilirubinaemia secondary to G6PD deficiency results in an increased risk of kernicterus and death, whereas in others, this has not been observed (5). This may reflect mutations that are specific to ethnicity, altering the susceptibility to develop kernicterus. The explanation for the higher frequency of clinical manifestations of G6PD deficiency in the neonatal period is due the limited capacity of the neonatal liver to metabolize and eliminate bilirubin, and the limited capacity of the red blood cells of the neonate to withstand oxidative stress (6).

Neonatal screening for G6PD deficiency utilizing the semiquantitative fluorescent spot has been carried out in many countries, including Malaysia (7) and India (4). Its incidence is different in different ethnic groups. Though the exact incidence is not known, various studies have reported an incidence ranging 2-27% in different communities in India (8).

The quantitative measurement of G6PD coupled to a simultaneous evaluation of the haemoglobin (Hb) content in the sample, expressing the results in Units/gram hemoglobin (U/g Hb). Hb normalization will allow for correction of all samples against a selected standard or control used in the test by 'normalizing' all analyte values so that they correspond to the same quantity of sample (7) had established the normal reference range for G6PD enzyme activity level with more sensitive in detecting individuals with partial G6PD levels.

The newborn screening program of Sri Lanka is well established but confined to screening for congenital hypothyroidism (CH) (9). The aim of the study was to assess the feasibility of incorporating G6PD screening to the screening panel.

Methods

The ethical approval for the study was obtained from the Ethics Review Committee of Faculty of Medicine, University of Ruhuna. The study was

conducted in 4 out of 15 districts where the NBS program has been functioning for over 5 years. Since samples are sent from these districts for confirmation of CH, an already established mechanism exists to receive samples for screening of G6PD.

Dried blood spot samples received during two consecutive calendar months (May to June 2017) from these 4 districts were subjected to the initial analysis of G6PD enzyme levels.

The G6PD screening assay kit manufactured by MP Biomedicals Germany GmbH (Ref. 07G580307) which was utilized in the analysis, has G6PD, which in the presence of NADP⁺, catalyses the oxidation of glucose-6-phosphate to 6-phosphogluconate. The NADPH⁺ reacts with a color reagent in which a tetrazolium salt gets reduced to produce a distinct color. This color is measured colorimetrically at the optical density (OD) of 550nm (500-570nm) and is directly proportional to the concentration of G6PD present in the sample. The reduced tetrazolium salt can be measured in endpoint mode using two measurements (at zero minute and 10-15 minutes later) while the microplate remains in the incubator. The G6PD activity of the blood sample was calculated by comparing the rates of the sample to rate of the normal control with known G6PD activity and measuring the haemoglobin level of the sample (Hb Normalization) at the OD of 405nm. The following formula (Greek Patent # 1003227; International Patent Pending) expresses each subject's G6PD levels in U/g of Hb.

$$\frac{(\delta \text{ OD sample } 550\text{nm}) / (\delta \text{ OD control } 550 \text{ nm}^2)}{(\text{OD sample } 405\text{nm} / \text{OD control } 405\text{nm})} \times \text{Control Value}$$

¹ $\delta \text{ OD sample } 550\text{nm} = \text{Final OD sample } 550\text{nm at } 15 \text{ min} - \text{Initial OD sample } 550\text{nm at } 0 \text{ min}$
² $\delta \text{ OD control } 550\text{nm} = \text{Final OD control } 550\text{nm at } 15 \text{ min} - \text{Initial OD control } 550\text{nm at } 0 \text{ min}$

In the above formula endpoint mode was used for the measurement of G6PD activity and analyzed in singleton. The difference between the final and the initial OD reading was used. Control value was provided by the manufacturer.

G6PD activity levels were reported as totally deficient, partially deficient or normal in order to reassess in a second sample after 6 months. Babies with residual activity range < 2.5 U/g Hb during initial screening were informed and recalled a second dried blood spot sample after 6 months to validate the G6PD enzyme activity. All these

infants' data were traced from newborn screening information system database (www.nsisd.ruh.ac.lk) and parents were contacted through mobile phone or by a letter to parents to collect the second sample after 6 months (i.e., December 2017 to February 2018). Parents were given instructions to meet the consultant pediatrician of the respective hospital (where the baby was delivered) and to obtain a fresh heel prick blood sample to be delivered to the laboratory through the hospital sample delivery system.

Data were compared at district levels to give incidence rates.

Results

Altogether, there were 8795 dried blood spot samples (4680 in May and 4115 in June) collected during the study period from hospitals in the selected districts (Table 1). The range of the measured G6PD activities was 0.5 – 13.8 U/gHb with inter assay variation of 2.7% (13.81 U/gHb). When the limit of sensitivity to represent a change in absorbance is 1 mOD/min (0.001/min) of G6PD activity at 550 nm, the detectable level of G6PD activity will increase by 0.9 U/g Hb. Using kinetic mode and four decimal displays, the detection limit becomes 0.3 U/gHb. Subjects were classified according to the obtained result as follows: Totally deficient: residual activity range < 2.5 U/gHb; partially deficient : residual activity range 2.6 – 6.5 U/gHb; normal: with residual activity > 6.6 U/gHb. There were 215 samples with residual activity < 2.5 U/gHb on initial analysis.

For the second analysis we received only 114 samples resulting nearly 50% non-respondent rate (Table 1).

Analysis of second samples revealed that 58 babies (36 males and 22 females) continued to have low residual activity (< 2.5 U/gHb) after 6 months of life. The incidence of G6PD deficiency during the study period in this selected population was 1 in 155. Highest percentage (45%) of positive babies was from Hambantota District and the lowest percentage (2%) was from Ratnapura District.

Discussion

We report the incidence of G6PD deficiency for the first time among Sri Lankan neonates. In the context of G6PD screening, the most common approach has been to include G6PD screening within other screening programs, typically CH screening (10). The gene, which encodes for G6PD is located on the X-chromosome (7). Since boys inherit the X-chromosome only from their mothers, it is known that mothers are also partially deficient in G6PD. Further, it revealed that intermediate enzymatic activity is present in Greek and Albanian mothers and in the cord blood of their female newborns (11). For many years, G6PD deficient heterozygotes were not regarded as being at risk (12). However, Kaplan *et. al*, in 2001 (13) have shown that heterozygotes with minimal haemolysis are also at similar risk for hyperbilirubinaemia as G6PD homozygotes in the newborn period.

Table 1: G6PD Screening results

District	No. of samples		Screening Positive ¹	Repeat analysis ²		Incidence ⁴
	May	June		Responded	Confirmed ³	
Ratnapura	1431	1210	9	3	1	1 in 2641
Matara	917	690	53	27	18	1 in 89
Galle	1499	1566	61	30	13	1 in 236
Hambantota	914	740	92	54	26	1 in 64
Total	8967		215	114	58	1 in 155

¹G6PD activity with Hb normalization < 2.5 U/gHb on first dried blood sample

²Responded to repeat analysis after 6 months

³G6PD activity with Hb normalization < 2.5 U/gHb on second dried blood sample

⁴Number of confirmed G6PD deficient babies per number of babies delivered during the study period

The diagnosis of G6PD deficiency is made by a quantitative spectrophotometric analysis or, more commonly, by a rapid fluorescent spot test detecting the generation of NADPH from NADP⁺ (6, 14). Hemoglobin normalization is a procedure which could be used in a variety of platforms and tests. We believe that the implementation of this procedure would greatly benefit newborn screening. In this aspect, haemoglobin normalization will allow for correction of all samples against a selected standard or control used in any assay by “normalizing” all analyte values so that they correspond to the same quantity of sample (15). It has been challenging to define a single universal normal (100%) G6PD activity value, so that classification of the G6PD status of an individual is defined as the percentage of a normal value determined locally (10). G6PD phenotype classifications for purposes of test performance evaluation were described in 2016 by the WHO (16) where males with less than 30% activity are considered as deficient and females with less than 30%, 30-80%, and greater than 80% G6PD activity are considered G6PD deficient, intermediate, and normal, respectively. Further, it was mentioned that the cost-effectiveness of screening, the frequency and severity of G6PD deficiency in a specific population, availability and efficacy of appropriate diagnostic options, and the capacity of the health system to provide appropriate counseling to parents and providers (17) should be considered prior to implementing such robust screening program.

In this study, 215 neonates were detected with deficient G6PD levels out of approximately 9,000 neonate samples on first screening. Of them, 101 neonates could not be followed up at 6 months for repeat sampling. This high attrition rate could be due to several reasons. There was no pretest counseling as G6PD tests were done in samples received for CH screening using the second blood spot. There were no dropouts in CH screening, but the recall takes place immediately within few days of the receipt of the samples and there is adequate pretest education and counseling in the CH screening program. This may change if the pretest counseling process is introduced for G6PD deficiency program in order to have a high recall rate (9). This was an initial attempt to identify the presence of G6PD deficiency in a population study and study the ability

to test for G6PD deficiency and feasibility of introducing the G6PD screening to the current NBS program. Further, we did not educate and seek the assistance from public health midwives to trace these babies. This would be a classic example for any screening program being unable to achieve its objectives as a result of not being incorporated to the existing public/national health systems. However, G6PD deficiency was diagnosed in 58 (27%) neonates at confirmatory testing showing that, it is feasible to introduce G6PD deficiency screening into the NBS program in the country as the existing laboratory has the capability to handle it.

There were studies that attempted to determine the prevalence of G6PD deficiency in regional level in Sri Lanka (18) among adult hospital attendees. However, all these studies reported that more females were affected than males. In our study, out of the 58 deficient neonates, 36 were males while 22 were females with the ratio of 1.6 : 1. In a two year follow up study in India, male to female ratio of G6PD deficient neonates was 5.4 : 1 (4). In two studies conducted in India male to female ratio of G6PD deficient neonates were 1 : 1 (19) and 3 : 1 (20) respectively, even though G6PD deficiency is expected to be rare in females as it is an X-linked recessive disorder.

G6PD deficiency is currently considered in the differential diagnosis of neonates who develop hyperbilirubinaemia within the first 24 hour of life, those who have a sibling with history of jaundice and who have bilirubin levels greater than the 95th percentile (4). Clinicians investigate these high-risk children for G6PD deficiency after a few months. However, G6PD deficiency may remain silent; hence, it is to be emphasized that the screening should be universal given the high incidence in this study population if subsequent morbidity related to hemolysis following oxidative stressors are to be avoided. Further, Hambantota and Matara districts in the Southern province were previously considered as malaria endemic areas and it is noteworthy that higher percentages of babies were detected from this area.

This disorder also fits into the criteria for screening laid down by Wilson and Jungner in 1962 for the implementation of newborn screening (21). It is sufficiently common, has a robust diagnostic test,

if undetected can lead to adverse consequences of hemolysis and renal shut down, and can be managed with ease. The cost-effectiveness for the diagnosis of this disease is such that it does not require active management in a resource-poor setting. Since the blood of dried blood spot on a filter paper is enough, transport is easy to a regional center, rather than multiple laboratories, across the country that may serve the purpose. We emphasize the need for expanding the panel of NBS to include G6PD deficiency as an important public health perspective. The high incidence observed and possible disastrous sequelae may make it an important candidate disorder for NBS panel with an added advantage as it requires no long-term cost for management.

Conclusions

In conclusion, we conducted a comprehensive newborn screening of G6PDD in a large cohort of population from Southern Sri Lanka. The cut-offs we have defined at 6 months may be at a disadvantage with high attrition but it saves the cost of additional genetic analysis.

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References


- De Jesus VR, Mei JV, Cordovado SK, *et al.* The Newborn Screening Quality Assurance Program at the Centers for Disease Control and Prevention: Thirty-five Year Experience Assuring Newborn Screening Laboratory Quality. *International Journal of Neonatal Screening*, 2015; **1**(1): 13-26.
- De Jesus VR, Mei JV, Bell CJ. Improving and assuring newborn screening laboratory quality worldwide: 30-year experience at the Centers for Disease Control and Prevention. *Semin. Perinatol*, 2010; **34**: 125-33.
- Mason PJ, Bautista JM, Gilsanz F. G6PD deficiency: the genotype-phenotype association. *Blood Review*, 2007; **21**: 267-83.
- Goyal M, Garg A, Goyal MB, Kumar S. *et al.* Newborn screening for G6PD deficiency: A 2-year data from North India. *Indian J Public Health*, 2015; **59**: 145-8.
- Mezzacappa MA, Facchini FP, Pinto AC, Cassone AE, Souza DS, Bezerra MA, *et al.* Clinical and genetic risk factors for moderate hyperbilirubinemia in Brazilian newborn infants. *J Perinatol*, 2010; **30**: 819-26.
- Frank JE. Diagnosis and Management of G6PD Deficiency. *Am Fam Physician*, 2005; **72**: 1277-82.
- Azma RZ, Hidayati N, Farisah NR, *et al.* G6PD enzyme activity in normal term Malaysian neonates and adults using a OSMMR2000-D kit with Hb normalization. *Southeast Asian J Trop Med Public Health*, 2010; **41**(4): 982-88.
- Mohanty D, Mukherjee MB, Colah RB. Glucose-6-phosphate dehydrogenase deficiency in India. *Indian J Pediatr*, 2004; **71**: 525-9.
- Amarasena S, Hettiarachchi M. Establishment of National programme on newborn screening for congenital hypothyroidism. *Sri Lanka Journal of Diabetes Endocrinology and Metabolism*, 2018; **8**(2), 13-8.
- Anderle A, Bancone G, Domingo GJ. *et al.* Point-of-Care Testing for G6PD Deficiency: Opportunities for Screening. *Int. J. Neonatal Screen* 2018; **4**: 34.
- Beutler E. The genetics of glucose-6-phosphate dehydrogenase deficiency. *Semin. Haematol*, 1990; **27**: 137-64.
- Alkhotani A, Eldin MN, Zaghoul A. Evaluation of neonatal jaundice in the Makkah region. *Sci Rep*, 2014; **4**: 4802.
- Kaplan M, Hammerman C, Vreman HJ. Acute haemolysis hyperbilirubinaemia in glucose-6-phosphate dehydrogenase deficient heterozygotes. *J Paediatr*, 2001; **139**: 137-40.
- Gregg XT, Prchal JT. Red cell enzymopathies. In: Hoffman R, ed. *Hematology: basic principles and practice*. 4th ed. Philadelphia: Churchill Living stone, 2000: 657-60.

15. Reclos GJ, Schulpisb KH, Gavrilić S. Evaluation of glucose-6-phosphate dehydrogenase activity in two different ethnic groups using a kit employing the haemoglobin normalization procedure. *Clinical Biochemistry*, 2003; **36**: 393-5.
16. World Health Organization (2016). Technical Specifications Series for Submission to WHO Prequalification-Diagnostic Assessment: In Vitro Diagnostics Medical Devices to Identify Glucose-6-Phosphate Dehydrogenase (G6PD) Activity. WHO, Geneva.
17. Watchko JF. Screening for glucose-6-phosphate dehydrogenase deficiency in newborns-practical considerations. *J. Pediatr*; 2002; **161**, 179-80.
18. Premawardhena A, Perera PS. Anaemia in Sri Lanka: the missing pieces. *Ceylon Medical Journal*, 2018; **63**: 105-7.
19. Bisoi S, Chakraborty S, Chattopadhyay D. Glucose-6-phosphate dehydrogenase screening of babies born in a tertiary care hospital in West Bengal. *Indian J Public Health*, 2012; **56**: 146-8.
20. Joshi SR, Patel RZ, Patel HR. High prevalence of G6PD deficiency in Vataliya Prajapati Community in western India. *Haematologia (Budap)*, 2001; **31**: 57-60.
21. Dobrow MJ, Hagens V, Chafe R. Consolidated principles for screening based on a systematic review and consensus process. *CMAJ: Canadian Medical Association Journal*, 2018; **190**(14): E422-E429.

Service quality of psychiatric care from patients' perspective; a descriptive cross sectional study conducted in National Hospital, Sri Lanka

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ABSTRACT

Introduction: In Sri Lanka, mental health has been given a low priority, despite one out of ten in population suffering from a mental illness. Most patients are treated and followed up at psychiatric clinics at government hospitals.

Methods: A descriptive cross sectional study was conducted in the psychiatric clinics in the National Hospital, Sri Lanka (NHSL). The objective of the study is to assess the quality of the services provided by the psychiatric clinics from patient's perspective and to identify the factors affecting the quality of the service. A sample of 292 clinic attendees in remission, followed up at the clinics for =1year, were selected using systematic sampling. Perception and expectations on five quality dimensions of SERVQUAL model (tangibles, reliability, responsiveness, assurance and empathy) was assessed using pre-tested, interviewer administered questionnaire with 30 items, on 05 points Likrt's scale.

Results: Tangibility dimension scored the highest mean (1.4816) and assurance scored lowest mean (1.1054), for expectations. Responsiveness scored the highest mean (2.9816) and tangibility scored the lowest mean (2.1379) for perceptions. Overall perception mean (2.548) regarding quality of service was higher than over all expectation mean (1.218) with a positive gap (1.2). Perception of tangibility was significantly associated with level of education ($p = 0.004$), ethnicity ($p = 0.010$) and unemployment had a significant impact on dimension empathy ($p = 0.03$).

Conclusions: Perception of the psychiatric services at NHSL was found to be better than their expectation. Even though results showed positive quality gap in relation to patient perspective, most of the facilities should be improved.

Key words: *Perception, expectation, service quality, quality gap*

Introduction

World Health Organization stated that "There is no health without mental health." It reflected clearly that mental health is an integral part of health. Around 450 million people are suffering from such conditions around the world (1). Every one in four people will be affected by a mental or neurological disorder any time in their life placing the mental health disorders one of the leading causes for morbidity and disability (2). In South East Asian

countries, mental health services lack attention and less invested. Service qualities of the available services are also reported as poor (3). According to the statistics, one out of ten was suffering from a psychiatric illness in Sri Lanka and only 20% seek treatment (4). A high incidence of child and adolescent mental health problems are also being reported (5). In early 90s the country was notorious for having the highest suicide rates in the world and the figures reported were 46 per 100,000 for males

and 19 per 100,000 for females (6). It is reported that 28.8 die from every 100,000 in Sri Lanka far above the global average of 11.4 per 100,000 population (7). Therefore it is very important to provide better service for mentally ill patients.

In the history of mental health services in Sri Lanka, mentally ill patients were housed in a separate asylum which was established by the British (8). At present, it provides inpatient care as well as outpatient medications, follow up care, referring patients for admissions, electro convulsion therapy (ECT) and psychotherapy and counseling care in a massive scale as the National Institute of Mental Health or the only mental hospital in Sri Lanka. In addition to the care provided by the National Institute of Mental Health, 22 out of 25 districts provide inpatient as well as outpatient care (9). Altogether, 86 outpatient clinics and 250 outreached clinics provide the services all over the country (4). Services provided by the clinics include arriving at a diagnosis, ordering investigations ranging from simple blood investigations to complex CT scans, prescribing psychosocial interventions, occupational therapy and rehabilitation care are other services provided.

Service quality is defined in business dictionary as an assessment of how well a delivered service conforms to the client's expectations. Not like product quality, service quality is intangible and is judged by the individuals on the perception of the service (10). According to Grönroos, (11) in order to increase the long term quality of service, the customer expectations should be focused, revealed, and calibrated. There are many models to assess the service quality. Out of them the most popular model for quality assessment is SERVQUAL model which was developed by the Parasuraman *et al.*

Quality mental health care is a newly prioritized area in the world. The identified issues related to mental health care provision are; lack of awareness about

the available facilities among mentally ill patients, reluctant to accept that they are suffering from a mental disorder due to the social stigma, fear of being discriminated at health care settings, poor attitudes towards public health services and thoughts related to privacy and confidentiality (12) in the psychiatry clinics. Therefore it is important to know how the patients feel about the provided care, in order to make improvements in the future. Even though there were studies done to assess the service quality of medical and other clinic setups, data on psychiatric service quality was scarese.

This study was conducted to assess the quality of the services provided by the psychiatric clinics at NHSL from patients' perspective and to identify the factors affecting the quality of the service.

Methods

A descriptive cross sectional study was conducted at psychiatric clinics of NHSL with quantitative approach. A sample of 292 patients who were being treated at psychiatric clinics was selected for the study through systematic sampling method. The inclusion criteria were as follows: patients who were in remission (was no longer experiencing clinical levels of symptoms related to the original issue) (13), who have been routinely attending the clinics for one year or more and patients who were capable and suitable to give the consent and understand the information were included in the study. The suitability of the patients was decided by the treating psychiatric team. Patients who came in for first visit to the psychiatric clinics (whose diagnoses were not yet established), unplanned visits to the clinics such as those requested to come to review the treatment response after a few days and those who came on a different clinic days than they were assigned to, where the treatment team is different were excluded from the study.

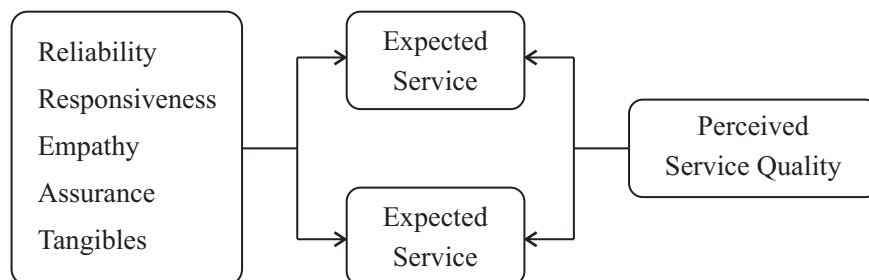


Figure1: Conceptual framework of SERVQUAL model

A voluntary participation was encouraged throughout the process. Pretested interviewer administered questionnaire was used for data collection. It was prepared referring the SERVQUAL model (14) which was the most commonly used service quality assessment tool in literature. It has been successfully used in health care quality assessments too.

The dimensions of the model were,

1. Reliability - Ability to perform promised service dependably and accurately
2. Responsiveness - Willingness to help and positive prompt service
3. Empathy - Caring and individualized attention that provides
4. Assurance - Knowledge and courtesy of employees and their ability inspire trust and confidence
5. Tangibles - Physical facilities, equipment and appearance

Data collection tool

Original SERVQUAL questionnaire had 22 statements. Principal investigator used same dimensions but modified and additional items were added to the questionnaire to measure the psychiatry clinic attendees' expectations and the perception regarding service quality. Focus group discussions were held with psychiatric team to determine what and how to set the statements on expectations and perceptions. The questionnaire composed of two parts. While the first part was related to socio demographic data such as age, gender ethnicity etc., second part covered the patients' expectations and perception regarding quality of services provided by the psychiatric clinics of NHSL. Questionnaire was prepared in all three languages; Sinhala, Tamil and English. Ethical and administrative approval was taken to conduct the study. Measures were taken to preserve the privacy, confidentiality and the autonomy. Statistical package for social science (SPSS) version 21 was used to analyse data. The socio demographic profile of the respondents were analyzed and presented in percentages. Mean expectation score and perception score for each dimension were calculated. The gap score was calculated by perception minus expectation scores for each dimension. (12). It was represented in a radar chart.

Two categories of favorable expectations and unfavorable expectations and the two categories of favorable perceptions and the unfavorable perceptions were decided in order to check the positive associations with the independent variables such as gender, ethnicity, age, civil status and current level of employment using the chi-square test. Each positively worded question and the negatively worded question were given 1-5 marks. It was decided that at least 4 out of 5 marks should be obtained for favourable level of expectation and the perception.

Results

After excluding the non-respondents (n = 14) and questionnaires with incomplete responses (n = 06), 272 respondents were included for the analysis. There was almost equal percent of respondents in the 35 - 44 years (21.7%) and 45 - 54 years (22.4%) age groups. Two thirds of the participants were Sinhala (65.8%). Out of the participants majority were studied up to grade ten (n = 127, 45%). However, only 26.5%, (n = 72) had passed the GCE O/L; 14.3% (n = 38) studied up to GCE A/L and 11.3% (n = 31) passed at least one subject of GCE A/L. there were 3.7% of basic degree holders. Only 1.5% (n = 04) of the participants had never been to school. Of the participants, 68.3% (n = 186) were not employed and there were more males (59.2%) compared to females (40.8%). Approximately, half of the participants, were married (53.3%, n = 145) while one third were unmarried (34.2%, n = 93). Considerable number of the participants (29.8%, n = 81) were travelling for more than 50 km to come to the clinic and only 10% (n = 27) resided less than 10 km from the NHSL. Main mode of transport of the study sample was by bus (61%, n = 166). Some participants had their own vehicles (18.4%).

Table 1 shows mean values for each dimension of the SERVQUAL model for patients' expectations. Tangibility scored the highest mean value (1.4816) while assurance scored the lowest value (1.1054).

Responsiveness scored the highest mean value (2.9816) and tangibility scored the lowest mean value (2.1379) for perception (table 2). When compared with the mean values for expectation, tangibles which the respondents expected most were found to receive the least by the respondents.

Table 1: Mean values for each dimension of the SERVQUAL model for patients’ expectation

Dimension	Mean Value
Tangibility	1.4816
Reliability	1.1412
Assurance	1.1054
Responsiveness	1.1812
Empathy	1.1820
Total	6.0914

Table 2: Mean values for each dimension of the SERVQUAL model for patients’ perception

Dimension	Mean Value
Tangibility	2.1379
Reliability	2.3184
Assurance	2.8401
Responsiveness	2.9816
Empathy	2.4620
Total	12.74

Assurance which scored the least in terms of expectations received a comparatively better perception.

Analysis of the service quality gap

According to the Parasuraman *et al* (1988),

$$\begin{aligned} \text{Service Quality} &= \text{Perception} - \text{Expectation} \\ &= (P-E) \end{aligned}$$

$$\begin{aligned} \text{Total mean for perception} &= 12.74/5 \\ &= 2.548 \end{aligned}$$

$$\begin{aligned} \text{Total mean for expectation} &= 6.0914/5 \\ &= 1.218 \end{aligned}$$

$$\begin{aligned} \text{Service quality gap score} &= 2.548 - 1.218 \\ &= 1.230 \end{aligned}$$

A positive quality gap score indicates that the quality of the provided service was better than the respondents’ expectation (12) (Figure 2).

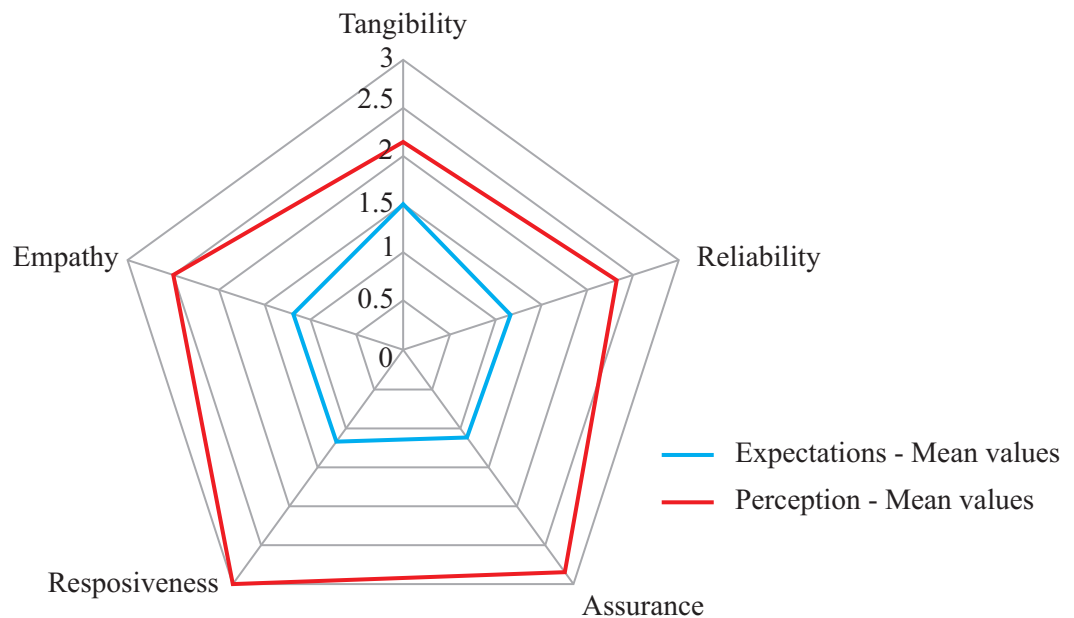


Figure 2: Gap analysis represented in radar chart

Factors affecting the quality gap

Analysis of the individual questions in the questionnaire revealed the factors affected for the quality gap. Summary of the factors that affected positively, according to the dimension are given in table 3. Factors of each dimension scored the lowest and contributed least for positive gap are shown in table 4.

Participants with favourable and unfavourable expectations were cross tabulated with age, gender, and civil status, level of education and current level of employment to find out possible associations. Similar analysis was done for participants with favorable and unfavorable perceptions.

None of the other independent factors were positively associated with the dependent variables ($p > 0.05$) studied except level of education ($p = 0.015$), unemployment ($p = 0.96$) and ethnicity ($p = 0.06$).

Perception of tangibility was significantly associated with level of education ($p = 0.05$), unemployment ($p = 0.004$) and ethnicity ($p = 0.010$). Unemployment had a significant impact on dimension empathy ($p = 0.03$).

When trying to categorize the participants into those with favorable vs unfavorable expectations, all the participants were found to be under the unfavorable level of expectations as per the cut-off used. Therefore, statistical analysis could not be performed for associations with the selected independent variables. Associations could not be done for the overall service quality gap as there were no evidence in the literature regarding this analysis.

Table 3: Summary of the factors affected positively according to the dimension

Dimension	Factors affected positively with highest scores
Responsiveness	Patients perceived that the health care providers give prompt service to the patients attracting their trust
Reliability	As all the relevant investigations are ordered at the first visit, patients don't need to come frequently
Assurance	Availability of all the essential drugs in the clinics and no need to purchase from outside pharmacy
Empathy	Consultation time is adequate to discuss patients' matters in the clinic
Tangibility	The health care providers in the clinics were neatly dressed

Table 4: Summary of factors least contributed for positive gap according to the dimension

Dimension	Factors
Tangibility	Welcome of the staff was poor
Responsiveness	Staff didn't prepare everything in orderly manner to provide quick service e.g. clinic records, books and drugs are not kept in a way of easy access
Reliability	All the relevant services such as adding drugs or investigations depending on the treatment response were not done at one visit.
Empathy	Operating hours in the clinics are not convenient for all the patients
Assurance	Clinic set up does not suit to maintain the privacy and confidentiality

Discussion

Due to the scarcity of studies done on quality assessment of psychiatric services locally, current study was compared with studies done in medical and related clinics. Most of the patients followed up in medical clinics were above the age of 50yrs, females and lived in catchment areas (< 10 km) (15). This study showed that the psychiatric patients were predominantly male as they are the vulnerable group and they can be victim to the illness before reaching the middle age. Majority of the psychiatric patients lived > 50 km away and travelled to the clinics where they did not stigmatize and were able to get drugs.

A similar study done on attendees to accident and emergency department of Teaching Hospital Kurunegala (16) revealed that the highest score was obtained for tangibility dimension. This score is very much similar to the tangibility score obtained in this study for expectation. It implied that patients' expectation mainly centered on physical facilities and appearance. Assurance scored the lowest score which is also similar to our study (16). The reason may be that in our setup most of the patients do not know that they have a right to know the qualifications and competency of the care giver and they believed that care is always provided by the qualified people.

In the current study responsiveness scored the highest perception, in contrast to the results of the study done at Teaching Hospital Kurunegala (16). It may be due to the fact that most of the staff categories help the psychiatric patients in a sympathetic way without hurry. In this study, it revealed a positive quality gap where patient's expectations were fulfilled. The qualities of the care givers may have contributed to it. In contrast, the study done in Kurunegala (16) revealed negative quality gap for all SERVQUAL dimensions where the expectations of the patients were not met. In our study, the finding of positive quality gap may be due to either patients expected less as they thought that they were marginalized people and discriminated by the society or they perceived more than they expected. Responsiveness was the main contributor for the positive quality gap where they perceived healthcare workers offered prompt service and have won their trust.

Different findings were revealed at Kurunegala where the patients expected health care workers to explain more about the illness and expected the staff to have good hygiene (16).

The study identified that there was significant impact exerted on the perception of the dimension empathy by participants' age, ethnicity, educational level and the current level of employment similar to a study done at five private hospitals in Jaffna showing a significant impact on patient satisfaction by age and level of education (17). Similar study done by Kavitha (18) at Sri Gokulum Hospital, India, highlighted the impact of age and level of education on the quality gap of dimension empathy.

Conclusions

Patients' highest expectation was for the tangibility dimension which means that patients expected more on physical facilities and they perceived it as unsatisfactory in this clinic setup. Patients perceived that responsiveness of the clinic was high, may be due to doctors and other staff behaved in compassionate way. Patients were not much concerned about the capability and qualifications of the care providers of the clinic as they believed that all the staff categories were well trained and qualified for service delivery through the government clinics. The feeling of being marginalized and discriminated by the society may have contributed to the higher scores in perception than expectation which has contributed to an overall positive quality gap in this study. However, the need to improve the quality of human and physical resources at these settings in order to preserve the dignity and respect of the patients is recommended.

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References

1. World health Organization, (2016) WHO Mental health action plan. Available at: <http://www.who.int/mentalHealth> [Accessed 23rd April].

2. World Health Organization, (2013) Mental Health Action Plan 2013-2020. WHO Press, Geneva, Switzerland. 2017].
3. World Health Organization, (2001). World health report 2001- Mental Health: New understanding, New hope. Available at: <http://www.who.int/whr/2001/en/> [Accessed 23rd December 2016].
4. Wipulasena A. (2013) Poor mental health: National Institute can't cope with the demand, Sunday Times, 6th October.
5. Ministry of Health, (2014) mental health action plan (pp. 143-144). In Annual Health Bulletin: Medical statistics unit, Sri Lanka.
6. World Health Assembly, (2012). The global burden of mental disorders and the need for a comprehensive, coordinated response from health and social sectors at the country level.
7. Knipe DWCM, Fernando R, Pearson M, Flemming K, Onradson and David Gunnell, (2014) Suicide in Sri Lanka 1975–2012: age, period and cohort analysis of police hospital data Available: <https://bmcpublihealth.biomedcentral.com/articles/10.1186/1471-2458-14-839> [Accessed 28/02/17].
8. Harishchandra G. The evolution psychiatric services in Sri Lanka: *South Asian Journal of Psychiatry*, 2015; **2**:1.
9. Ministry of Health. (2015) National mental health programme. In Annual Health Bulletin: Medical statistics unit, Sri Lanka.
10. Parasuraman A, Zeithaml V & Berry LL. SERVQUAL: A multiple item scale for measuring consumer perception of measuring service quality, *Journal of Retailing*, 1988; **64**(1): 12-40.
11. Gronroos C. A service quality model and its marketing implications, *European Journal of Marketing*; 1984; **18**(4): 36-44.
12. Ellepola Y. (2016). Why Sri Lanka needs better mental health care, CEYLON TODAY, 10th October.
13. Kennady S (2002). Assessing full remission, *Journal of psychiatry & Neuro-Science*; 2002; **27**: 233-4.
14. Parasuraman A, Zeithaml V & Berry LL. A conceptual model of service quality & its implications for further research, *Journal of Marketing*, 1985; **49**: 41-50.
15. Wijemanna WMUS (2011). Quality of service provision patients at medical clinics in secondary care hospitals in the Western province, Post Graduate Institute of Medicine.
16. Samarakoon DS (2014). Study on perceived and expected Quality of services by patients attending accident and emergency unit Provincial General Hospital Kurunegala, Post Graduate Institute of Medicine.
17. Sritharan S & Velanampy T. (2011). Service quality & customer satisfaction: A study of selected private Hospitals in Jaffna District, Sri Lanka.
18. Kavitha R. Factors influencing the service quality gap between Expectations and perceptions, A study at Sri Gokulum Hospital, *International Journal of Business and Management Invention*, 2012; **1**: pp. 30-36.

Tropical disease and imperial medicine in colonial Sri Lanka

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ABSTRACT

For centuries, cultural imperialism was at the heart of the Western colonizing project around the globe. Economic and health policies were twin pillars that sustained the material and cultural hegemony over indigenous populations. Medicine played a pivotal role, both as a tool of the colonial expansion and a potent symbol of the superiority of Western culture. This paper examines the impact of economic and health policies on the lives of Indian migrant labourers and the indigenous people of Sri Lanka during British colonial rule.

Key words: *Colonialism, disease, Rockefeller philanthropy, medicine*

Introduction

Western medicine introduced by European colonizers and missionaries has been portrayed as “God sent” for millions of lives in Africa, Asia, and the Americas. Western medicine represented a higher civilization and social order that lifted the “backward” people to modern ways of life. Medical missionaries believed that the eradication of fatal diseases among the indigenous people would encourage the “heathens” to embrace Christianity (1). Commenting on the effort to establish a public health department in India by the British colonial government in the mid-nineteenth century, Florence Nightingale observed: “it was not only a noble task but also a part of a mission to bring a higher civilization into India” (2). However, even though Western medicine was regarded as an integral part of culture, medical services were rarely extended to the masses without reservations.

By contrast, several studies have argued that medicine and medical services in the colonies evolved in response to the political and economic needs of Western imperialism. They suggest that medicine played a critical role in the expansion of imperialism in the late nineteenth and early twentieth

centuries (3). Medicine, as it was introduced to non-Western societies by imperial forces, was an instrument of political, economic, and cultural domination. With the expansion of European colonialism in Asia, Africa, and Latin America, the threat of “tropical disease” became a major obstacle to colonial rule. Malaria was the biggest enemy of the British troops in early nineteenth century Sri Lanka. From 1817 to 1836, among the military personnel serving in the island, the death rate per thousand was 75 compared to that of 15 per thousand in Britain during the same period. None of these deaths was due to military activity (4). The annual death rate among Europeans in West Africa in the late eighteenth century was between 300 and 700 per thousand - a scenario that led to Africa being called a “white man's grave” (5). New medical sciences were developed to deal with diseases such as cholera, malaria, dysentery, and yellow fever for the protection of the European troops and administrators from diseases originating in the indigenous communities. The fact that the impetus for the development of Western medicine in British India was the concern of the health of the British army and the European expatriates created medical “enclaves” across India that practically excluded the

majority of the local populations. Such policies were justified by the colonial administrators who contended that the Indians were “superstitious and backward,” and would not accept modern medicine even if it were offered (6).

Colonial economic and labor practices were major contributors to the spread of epidemic disease. Yet, medical services were not extended to local population until it became apparent that the health of the European personnel, particularly members of the military, could not be protected by measures directed at them alone (7). The growing trade and the demand for raw materials not only increased the exploitation of land and other resources, but also demanded the mass mobilization of cheap labor across colonies, a practice that directly contributed to the spread of disease.

Against this backdrop, we examine the impact of British colonial labor practices on the health of South Indian immigrant workers on the plantations and the local population of Sri Lanka (formerly known as Ceylon) as a case study. We contend that the *laissez-faire* policy of the colonial government empowered the British planters to ignore even the most basic sanitary requirements such as latrines on the plantations in order to maximize profit. As a result, the plantations became breeding grounds for many parasitic and infectious diseases found on the island during the late nineteenth and early twentieth centuries. When the International Health Board (hereafter IHB) of the Rockefeller Foundation arrived in Sri Lanka in 1916 to set up a hookworm control campaign, there was an epidemic of hookworm infection on the plantations and the neighboring villages.

Philanthropic medicine, which came to assist the British planters, also served the long-term political and economic interests of American industrial capitalism. Rockefeller philanthropic medicine failed to eradicate hookworm disease on the plantations because planters, not perceiving the mutual interdependence of their own economic interests and the health of the colonial labor, did not fully cooperate with the program (8).

Historical background

The British captured the Kandyan Kingdom of Sri Lanka in 1815, slaughtering thousands of natives and destroying scores of villages (Marshall 1846). Dr. Henry Marshall, a senior medical officer of the 89th Regiment that led the war against the Kandyan Kingdom, wrote that “the incursions of our troops into the Kandyan territory... were calculated to fill the population with the most unfavorable opinions of our justice and humanity, and to confirm the worst prejudices against the European race” (9). As Marshall predicted, the resentment of the Kandyan Sinhalese towards British rule persisted. When the British established plantation industries in central Sri Lanka during the mid-nineteenth century, the Kandyan refused to work on the estates. To fill this deficit, laborers were brought from the Southern Indian state of Tamil Nadu for the year-round work in the plantation industry (figure 1). By the turn of the century, about 100,000 workers and their families arrived annually in Sri Lanka. The sanitary conditions on the estates were deplorable (10).



Figure1: A typical workers' line on the plantations.

Courtesy of the Rockefeller Archive Center

Hookworm epidemic on the plantations

Hookworm infection was first reported in the administration report of the Principal Civil Medical Officer (PCMO) of Sri Lanka in 1888, when 31 cases were diagnosed at hospitals in Colombo, Badulla, and Kurunegala (11). This number increased rapidly and by 1899, about 239 deaths from *anchylostomiasis* had been reported on the island. According to Allan Perry, PCMO, over 80 percent of the reported cases were immigrant workers, and the rest were people living in the neighboring villages of the plantation areas. Although the authorities were fully aware of the cause of the disease, they were reluctant to interfere with the private economic decisions of the planters. Despite the fact that a large number of the immigrant laborers arriving in Sri Lanka each year seldom lived more than “a couple of monsoons,” the planters were not bothered with the high death toll. According to historians, in the years between 1841 and 1848, about 70,000 (10,000 per year) or 25 percent of the immigrant workers died of various causes (12). By 1916, the hookworm disease had reached epidemic proportions. As Table 1 shows, more than 90 percent

of the population on the plantations was infected with the disease (figure 2).

Large European firms owned the plantations. In general, the business dealings of these firms were mostly conducted directly with the Colonial Office in London, which was sympathetic to these large firms. This allowed the firms and their estate companies to ignore the local policies of specific colonies, including those of Sri Lanka. For a variety of ideological, political and economic reasons, both the colonial government and planters prevented effective control of the hookworm disease on the plantations. The official viewpoint was that the hookworm disease on the plantations was a problem for the planters to deal with in accordance with their own economic objectives. The planters, on the other hand, perceived no direct economic benefit from controlling and curing the hookworm disease. This stalemate persisted throughout the late nineteenth and early twentieth centuries, directly contributing to a great deal of suffering among the immigrant laborers. It was against this background that the IHB decided to conduct a hookworm treatment program on the plantation in Sri Lanka.

Table 1: Death from Hookworm Infection, Sri Lanka 1900 - 1922

Year	Estimated Population ^a	Death Rate Per Million	Year	Estimated Population ^a	Death Rate Per Million		
1900	Island	3,565,954	72.3	1913	Island	534.7	
	Plantation	441,601	217.3		Plantation	3449.1	
1904	Island	88.3	1914	Island	641.6		
	Plantation	346.4		Plantation	4348.8		
1905	Island	157.6	1915	Island	504.0		
	Plantation	656.7		Plantation	3269.9		
1906	Island	256.5	1916	Island	610.0		
	Plantation	1173.0		Plantation	4021.6		
1907	Island	266.6	1917	Island	624.6		
	Plantation	1259.0		Plantation	4035.3		
1908	Island	352.2	1918	Island	566.9		
	Plantation	1893.1		Plantation	3458.8		
1909	Island	416.7	1919	Island	635.1		
	Plantation	2497.7		Plantation	3412.0		
1910	Island	446.4	1920	Island	794.1		
	Plantation	2586.0		Plantation	4307.9		
1911	Island	4,106,350	489.7	1921	Island	4,498,605	651.3
	Plantation	513,467	2894.0		Plantation	568,850	3678.9
1912	Island	448.8	1922	Island	415.4		
	Plantation	3075.1		Plantation	2132.5		

^aPopulation figures for the Island and the Plantations are based on the 1900, 1911, and 1921 census. Department of Census and Statistics. *Census Data, Ceylon Year Book*, Colombo 1970; Rockefeller Archive Center, *Ceylon Population*, 4, 1914, Record Group 5, Series 2, Box 47; Sri Lanka National Archive, *Ceylon Administration Reports, Vital Statistics: Report of the Registrar General of Ceylon (1900-1922)*.



Figure 2: A severely infected plantation worker.
Courtesy of the Rockefeller Archive Center

Rockefeller philanthropic medicine in Sri Lanka

The IHB arrived in Sri Lanka in 1915 and began negotiating with both the colonial authorities and the management of the plantations in the hope of establishing a hookworm treatment program on the estates. From the outset, both the colonial government and the planters opposed any outside interference in their work, arguing that it would ruin their business. However, determined to convince both the planters and the colonial authorities of the vital importance of the treatment campaign for their business interests, Dr. Victor Heiser, the director of the IHB operations in the East, presented his case from an economic point of view. He argued: “a healthy labourer is an asset to an estate while an unhealthy labourer is a partial liability. It appears economical therefore to keep laborers healthy.” Dr. Heiser further strengthened the argument by pointing out: “disease never stays at home in its

natural breeding place of filth, but is ever and again breaking into the precincts of its more cleanly neighbors” (13). He noted that the IHB was prepared to bear more than half the cost of the project, an incentive that neither the government nor the planters could refuse. In the end, he succeeded in persuading them to allow the IHB to begin the treatment campaign on the plantations.

With the approval of the colonial government and the planters, the IHB began a hookworm control program in 1916 in a selected group of estates. The representatives of the IHB, Drs. J. E. Snodgrass, W. C. Sweet and W. P. Jacocks, developed a working plan for Sri Lanka that was to be supervised by American medical personnel appointed by the IHB. The government also promised to provide “every legitimate assistance” to the planters to improve sanitary conditions. This was an important change in government policy toward the plantation industry. An area of about 7 by 10 miles in the Matale district, comprising 24 estates with a population of approximately 10,000, was selected for the initial stages of the campaign. The program was gradually extended to other estates. Besides the treatment of those infected, the campaign consisted of experimenting with suitable types of latrines for the estates, paired with an information campaign about the cause and prevention of hookworm disease. In addition, the estate pharmacists were trained to diagnose the infection using microscopic and clinical techniques, and to administer proper doses of *chenopodium* oil as treatment (14).

By the end of 1917, the hookworm control campaign had treated about 40,000 people. Of these, 78 percent were pronounced *cured* upon microscopic re-examination. In addition, morbidity statistics were gathered from several estates, which showed the improvement in general health following the treatment for hookworm disease. The District Medical Officer of Matale reported that only 2,604 patients were admitted to hospitals in 1918, compared to 3,694 hospital admissions in 1916 before the hookworm control program was begun, a reduction of 27 percent (15).

In spite of these improvements in the health of workers, they were *not* enough to convince the planters to undertake the major sanitary improvements suggested by the IHB. As has been

noted, the crucial requirement for the control of hookworm disease was the construction of latrines. Although the planters had agreed to construct latrines at the beginning of the campaign, they did not honor their commitment. With pressure from the IHB, the government introduced legislation making it compulsory for all the estates to provide sufficient latrines for the workers' lines. While many estates constructed latrines to comply with the law, they used temporary materials that lasted only a few weeks (figure 3). The unabated soil pollution on the plantations combined with the arrival of infected new workers from India ensured a high rate of reinfection. At the end of 1919, three years after the completion of treatment, an examination of a sample of about 3,000 workers showed that the infection had not declined (16).

Failure of the hookworm control campaign

The hookworm control campaign on the plantations could not achieve its goal because the sanitary conditions were not improved while the treatments were being carried out. At this point, it became clear to the IHB that neither the government nor the planters were seriously concerned about the hookworm problem. Although sharing the cost of the program, the government was not fully committed to the objective of improving sanitary conditions on the estates. It did not want to antagonize the powerful planters by forcing them to construct latrines, nor did it want to take over the construction of latrines on the estates, as this might appear to be a change of the government's policy toward the plantations. The planters, for their part, believed that they could overcome the persistent complaints against them by letting the hookworm control campaign treat their labourers. However, anything that required capital spending was not something that they were prepared to undertake.

By the end of 1922, according to the annual reports, the IHB had spent \$195,048 for the hookworm control campaign in Sri Lanka. The campaign had treated a total of 413,175 individuals on the estates and neighboring villages. This amounted to less than 50 cents per person. The government provided for the salaries and expenses of local subordinate staff, drugs, equipment, offices and office supplies. The annual reports of the IHB describe the government's

spending as "an approximately equal division of the expense of the work". If that was the case, it can be suggested that from 1916 to 1922 the IHB and the government jointly spent about \$400,000 for the hookworm control program on the plantations (17).

The deaths from hookworm disease did not decline during this period. For example, out of ten major plantation districts where extensive treatments had been carried out, in only one district (Matale) had the number of deaths been reduced (by 13 per cent) between 1916 and 1919. In all the others, hookworm-related deaths continued to increase during the campaign, with disproportionately high numbers from 1917 to 1918, which were the years of the influenza epidemic. When the campaign began in 1916, an average hookworm-related death rate for these ten districts was 520, which rose to a peak of 619 in 1919. Several explanations have been given for this increase: 1) that doctors became aware of the disease and were making facile diagnoses, resulting in the attribution of more deaths to hookworm infection; 2) a rice shortage on the plantations during the World War I changed the diet to rougher foods which aggravated the disease; 3) for the first time, an administrative mechanism was developed to obtain accurate registration of vital statistics in 1919.

Despite these official interpretations of the increased deaths during the campaign, one cannot overlook the fact that the treatments could not prevent continued re-infection due to the poor sanitary conditions. Although the campaign reduced the number of worms each infected individual harbored, the rate of re-infection increased over time with the unabated soil pollution. This was the major factor that was never adequately tackled on the estates. Almost every annual report of the project directors and field doctors referred to the poor sanitary conditions, but the planters and the government always brushed off the problem with temporary solutions. Given the transparent importance of sanitation in controlling hookworm disease, it is hard to comprehend why the construction of latrines on the plantations was not given priority in the hookworm control campaign. It is in response to this question that the remainder of the paper is addressed.



Figure 3: An example of latrines built on a plantation - *Courtesy of the Rockefeller Archive Center*

Leaving aside the callous treatment of those in their employ, it should be clear that the planters' unwillingness to construct latrines rested principally on the issue of profit. They knew that it would cost them a certain amount of money to build the necessary permanent latrines and they perceived no economic or legal impediments to disregard such needs. The sanitation problem caused no serious labour shortages, owing to the ready supply of workers from India. Further, the planters enjoyed relative immunity from prosecution for failure to comply with even those sanitary regulations already in place. For its part, having begun to experience a degree of cordiality with the planters by the time of the program's implementation, the government seems to have been reluctant to press its legal hand over the matter of sanitation. The arrival of Rockefeller "philanthropic" medicine provided the government with some means to move away from its mutually confrontational relations with the planters in a way that would not jeopardize its dubious laissez-faire policy. The government was decidedly unwilling to accept responsibility for sanitary services as it reasoned this might - in the perception of the planters - appear to be a retreat from its own (self-serving) policy of non-interference. Realizing that endorsement of the hookworm campaign was

necessary, given the influence of the planters on the Colonial Office in London, the government of Sri Lanka eventually acquiesced perceiving no harm in playing a supportive role in the campaign. But the government's stated goal of eradicating hookworm disease was not its primary objective. This led to the curious result that it spent what was for that time a considerable amount of money in a largely futile exercise.

Finally, what accounts for the Rockefeller doctors' own failure to pursue more vigorously the importance of sanitary reforms on the plantations? Owing to past experience in elsewhere, the Rockefeller doctors were fully cognizant of the crucial relationship between latrines and the hookworm infection. The project director and the field doctors made frequent reference to the necessity of latrines on the plantations in their reports. The temporary latrines, which were constructed during the campaign, lasted only a few weeks, after which the problem of sanitation again became the major concern. From the beginning of the IHB's sojourn in Sri Lanka, senior representatives employed formidable diplomatic tact in bringing together the two hostile parties - the government and the planters - in order to initiate

the campaign on the plantations. To a certain extent it would seem that this rhetorical theme of diplomacy became the predominant tenor of discourse, imbuing all subsequent relations. And since it was so important in initiating the campaign, it was difficult to interrupt. As a result, the representatives of the IHB were required to play the role of mediator or broker between the government and planters, which compromised their ability to advocate sanitary reforms more forcefully in conjunction with treatments. Moreover, despite the field doctors' continual reporting of the sanitary problems on the plantations, there was no significant effort on the part of high-ranking officials to convert these concerns into tangible reforms (18).

However, there is another dimension to the failure of the hookworm campaign in Sri Lanka. It is that, being both trained and socialized by the theories and values of Western medicine, the medical personnel involved were products of, and enamored with, the emerging biomedical model. The IHB did not pursue the question of latrines forcefully with either the government or the planters because its aim was to *cure* the disease. For the Rockefeller Foundation, eradication of hookworm disease meant not only the increased productivity of labour but also a wider acceptance of Western cultural values by the people of European colonies. This was considered to be crucial for the future of American economic and political interests in those countries. It is ironic that the money spent on treatment could easily have provided a sufficient number of functioning latrines on the plantations. In spite of the persistent suggestions by the field doctors regarding the urgency of sanitation, the prevention of hookworm disease was never - not in an unequivocal manner, at least - considered an indispensable part of the agenda. This is because the main concern of the senior officials of the IHB was to "demonstrate" the curative power of Western medicine. In conclusion, it can be suggested that the control of hookworm disease through sanitary reforms was less alluring to the senior officials of the IHB and, consequently, was judged by them to be a less impressive display of Western culture in the ongoing publicity campaign.

NOTES:

Due to space limitation only a minimum number of archival sources are listed here. Interested readers can find a full account of archival materials on this topic in my book: Hewa, S 1995 *Colonialism, Tropical Disease and Imperial Medicine: Rockefeller Philanthropy in Sri Lanka*, Lanham, Maryland, University Press of America.

Reference


1. Comaroff J, Comaroff J. (1992). *Ethnography and the Historical Imagination*, pp. 215-233, Boulder, Westview Press.
2. Cook E. (1914). *The Life of Florence Nightingale*, Vol. 2, p. 1, London, Macmillan Press.
3. Headrick RD. (1981). *The Tools of Empire: Technology and European Imperialism in the Nineteenth Century*, New York, Oxford University Press; Arnold, D (1988) "Introduction," pp. 1-26, in D. Arnold (ed.) *Disease, Medicine and Empire: Imperial Medicine and Indigenous Societies*, Manchester, Manchester University Press.
4. Urugoda CG. (1987). *A History of Medicine in Sri Lanka, from the earliest time to 1948*, Colombo, Sri Lanka Medical Association.
5. Curtin PD. (1961). "The White Man's Grave: Image and Reality, 1780-1850," *Journal of British Studies*, 1: 94-110; Curtin PD. (1989). *Death By Migration, Europe Encounter With the Tropical World in the Nineteenth Century*, Cambridge, Cambridge University Press.
6. Ramasubban R. (1988). "Imperial Health in British India, 1857-1900," pp. 38-60, in R. Macleod and M. Lewis (eds.), *Disease, Medicine, and Empire: Perspectives on Western Medicine and the Experience of European Expansion*, New York, Routledge.
7. Worboys M. (1988). "Manson Ross and Colonial Medical Policy: Tropical Medicine in London and Liverpool 1899-1914," pp. 21-37, in R. MacLeod and M. Lewis (eds.) *Disease, Medicine and Empire: Perspectives on Western Medicine and the Experience of European Expansion*, New York, Routledge.
8. Hewa S. (1994). "The hookworm epidemic on the plantation in Colonial Sri Lanka," *Medical History*, Vol. 38, 1: 73-90.
9. Marshall H. (1846). *Ceylon, A General Description of the Island and its Inhabitants*, London, pp.120-21.

10. Rockefeller Archive Center (hereafter RAC), *Ceylon-sanitary and health conditions-hookworm disease*, 1-5, 1914, Record Group (RG) 5, series 2, Box 47.
11. Sri Lanka National Archive (hereafter SLNA), *Ceylon: Admin. Repts*, Colombo: PCMO and IGH, 1888), pp.11-12.
12. de Silva KM. (1965). *Social Policy and Missionary Organizations in Ceylon1840-1855*, London, Longmans, for the Royal Commonwealth Society, p. 239.
13. Heiser V. (1936). *American Doctor's Odyssey*, New York, W.W. Norton and Company, pp. 327-29.
14. RAC, *Working plan for the relief and control of anchylostomiasis in Ceylon*, 1916, 1-3, RG 5, series 2, box 48.
15. RAC, Relief and control of hookworm disease in Ceylon, 1918, 27-37, RG 5, series 2, box 47.
16. RAC, Ibid, pp. 18-20.
17. RAC, Relief and control of hookworm disease in Ceylon, 18-20, 1920, RG 5, series 2, box 47, pp. 23-4.
18. RAC, Letter from Dr. W.P. Jacocks to Dr. Victor Heiser, May 24, 1920, No 1132 RG5, series2 Box 47.

A sigmoidovesical fistula due to colonic tuberculosis

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Introduction

A colovesical fistula (CVF) is an abnormal connection between the colon and urinary bladder. Although they are uncommon, CVFs can cause significant morbidity, affect quality of life, and may lead to death, usually secondary to urosepsis (1,2). CVF is the most common form of the enterovesical fistulae and occurs mostly due to diverticular disease (65 - 80%), cancer (10 - 20%) or Crohn's colitis (7 - 10%) (2). Surgery, colonic stents, typhoid fever, syphilis and tuberculosis are rare causes of CVF. Although a CVF can be diagnosed clinically, imaging and endoscopy are often required to delineate the extent of a fistula and to elucidate its aetiology (3). Surgery is usually required to repair a CVF. We report a case of sigmoido-vesical fistula as a consequence of sigmoid tuberculosis.

Case presentation

A 54-year-old man developed frothy urine and passage of yellowish particles in his urine for one month. He did not have fever or other urinary symptoms such as dysuria, frequency, loin pain, lower abdominal pain or haematuria. There was no history of previous urinary tract infection or abdominal sepsis. There was no history of leg swelling or facial puffiness. His bowel habits were regular with no clinical evidence suggestive of colorectal malignancy, diverticulitis or tuberculosis. His general and system examination was normal. The abdominopelvic computed tomography with bladder contrast showed air in the bladder with no visible fistulous tract. Flexible sigmoidoscopy did not show any abnormality. Cystoscopy showed multiple fistulous openings in the dome and posterior wall of the bladder surrounded by areas of inflammatory changes. Preoperative chest X-ray was normal.

At laparotomy a colo-vesical fistula involving the sigmoid colon was evident. The fistulous tract and inflammatory mass was excised. Bladder defect was repaired and end to end colonic anastomosis was done. As the anastomotic site was low down in the pelvis a defunctioning ileostomy was done. Post-surgical period was uneventful. He went home on postoperative day three with the aim of keeping the urinary catheter for three weeks.

Few days later he developed fever. His abdominal and other system examinations were normal. His urine, blood and sputum cultures were negative. Ultra sound scan of the abdomen and pelvis did not show any intra-abdominal collections or any abnormality. The full blood count revealed white blood cells of $9.3 \times 10^9/L$ (Normal range [NR] $4.0 - 11.0 \times 10^9/L$) with neutrophils 59%; haemoglobin 10.6 g/dL (NR 13.5 - 16.5 g/dL) and platelet count of $436 \times 10^9/L$ (NR $150 - 450 \times 10^9/L$). C-reactive protein was 63 mg/L (NR <5 mg/L). ESR was 66 mm/1st hr. His Chest X-ray showed right side upper lobe consolidation. He was treated with intravenous antibiotics with poor response.

When the specimen was sectioned, a fistulous tract was identified, measuring 20 mm in length (Figure 1). The sections from the colovesical inflammatory mass showed large bowel mucosa with preserved crypt architecture. There was oedema of the lamina propria with dense acute on chronic inflammation (Figure 2). There was cryptitis and crypt abscesses too. Amidst this inflammation there were epithelioid cell granulomata with central caseating necrosis and Langhan type multinucleated giant cells (Figure 3 and 4). The inflammation extended through the mural wall. The margins of the resected colon were free of inflammation. Nine lymph nodes were found and they showed granuloma formation (Figure 5).

However, Ziehl-Neelsen stain did not show acid fast bacilli. His Mantoux test showed an area of 10 mm induration. Three sputum and serial urine samples for acid fast bacilli were negative. After considering the clinical, radiological and histopathological findings, the patient was started on standard four drug anti-tuberculous therapy. His fever settled, weight increased and other symptoms subsided. He underwent ileostomy reversal after 6 weeks.



Figure 1: Macroscopic appearance of the resected specimen

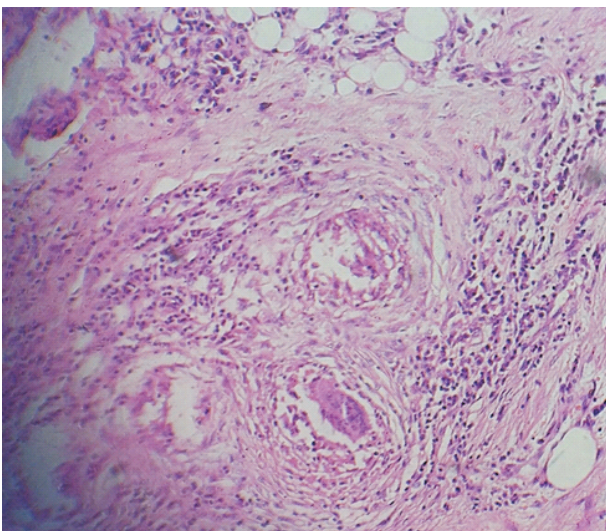


Figure 2: Granuloma in the wall of colon (H&E x 40)

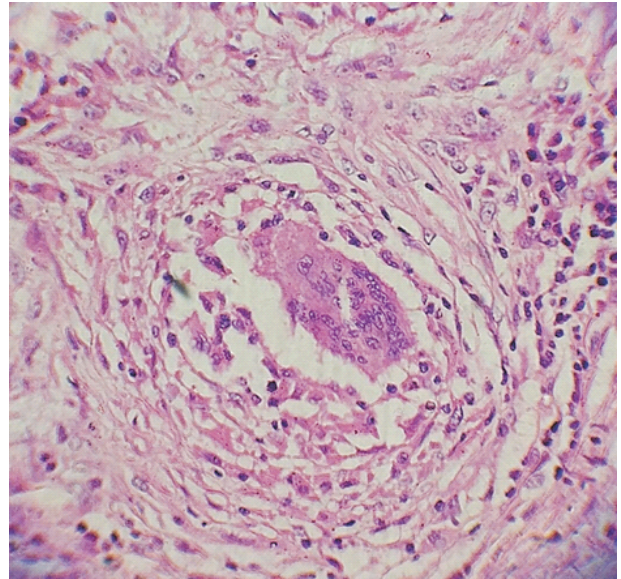


Figure 3: Granuloma in the wall of colon (H & E x 100)

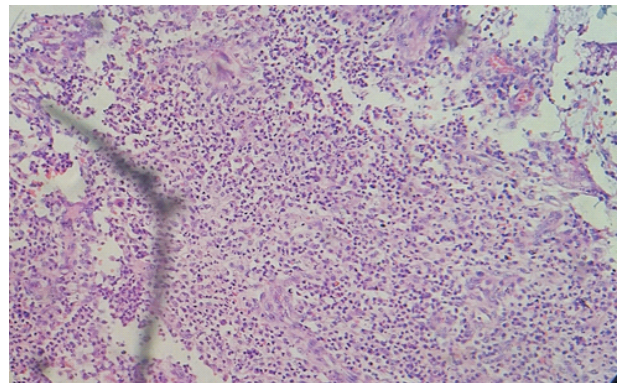


Figure 4: Surface ulceration in the wall of colon (H&E x 40)

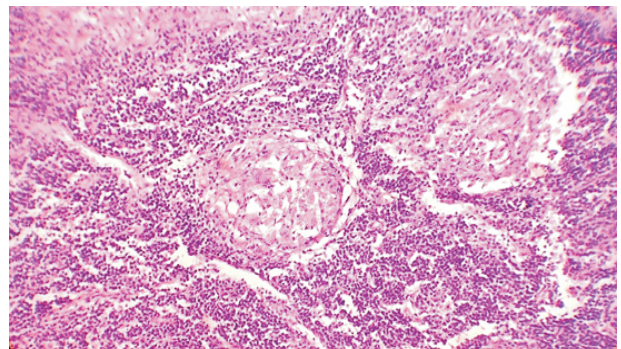


Figure 5: Granuloma in a lymph node (H&E x 40)

Discussion

Segmental or isolated colonic tuberculosis refers to involvement of the colon without ileocaecal region, and constitutes 9.2% of all cases of abdominal tuberculosis (4,5). It commonly involves the sigmoid, ascending and transverse colon. Multifocal involvement is seen in one third (28 to 44%) of colonic tuberculosis. The median duration of symptoms is less than one year. Pain is the predominant symptom (78-90%) and hematochezia occurs in less than one third (4,5). Bleeding is frequently minor.

Colovesical is the most common form of the vesicoenteric fistulae and can result from diverticular disease (70-90%), colorectal carcinoma (20%) or Crohn's disease (10%) (6). It is more common in men, with a ratio of 3 : 1 as uterus and broad ligaments act as a barrier between the sigmoid colon and the bladder. It is most common during the sixth and seventh decades of life and mean age of presentation is 55 to 75 years. Infections like typhoid fever, amoebiasis, syphilis, tuberculosis are rare causes of enterovesical fistulae (5-7). Biopsy helps in differentiating tuberculosis from Crohn's disease, and also excludes malignancy.

Patients with a CVF usually present with pneumaturia (50% to 90%) and faecaluria (40% - 70%). Other presentations are suprapubic pain, dysuria, urgency, frequency and haematuria (2). They may complain of gastrointestinal symptoms related to the underlying causes such as diverticulitis, colonic cancer, Chron's disease or tuberculosis. Diagnosis is confirmed by abdominopelvic computed tomography with oral/rectal or bladder contrast and it helps to diagnose around 72% patients with a CVF (2). Air in the bladder like in our patient may be a useful indicator when the fistulous tract is not obvious though its specificity is low. The lower gastrointestinal endoscopy has a low sensitivity in detecting a possible aetiology. However it is mandatory before planning surgical intervention in order to exclude a colonic malignancy eroding into the bladder. Cystoscopy is useful in detecting a fistula in 40%-80% of cases (3).

Treatment of CVF is primarily surgical after controlling the abdominal or urological sepsis with fluid resuscitation, antibiotics and drainage of

bladder with a catheter. The specific operative procedure depends whether the fistula is benign or malignant. If it is a non-malignant cause, single stage bowel resection with primary anastomosis without diversion is a better option. If potential for leakage is high or if patient cannot tolerate a prolonged surgery, multi-stage procedures can be safer. Minimal access surgery depends on experienced hands but have 30% conversion rate. Malignant fistulae are mostly due to colonic cancer and surgery should be based on usual oncological resection principles. Conservative treatment and endoscopic covered stenting of bowel for CVF is possible in selected patients but complications are more than surgical treatment. CVF of tuberculous origin is rare and our patient responded well to anti-tubercular treatment (5,7).

This case report highlights the importance of considering tuberculosis as a cause of colovesical fistula in developing countries like ours, as well as the efficacy of medical therapy for controlling such an advanced stage of the disease. Similar to other sites of tuberculosis, patients with CVF also will not have all tests positive for tuberculosis. Hence the need to look at the full picture of the case is essential for proper management.

Conclusions

Extra pulmonary tuberculosis presenting as sigmoidovesical fistula is a rare clinical presentation despite the fact that tuberculosis is the most prevalent infectious disease in Sri Lanka. Due to its rarity and lack of specific features to prompt preoperative diagnosis, early evaluation of histopathology after surgery would prevent any delay in commencing antituberculous therapy.

References

1. Garcea G, Majid I, Sutton CD. Diagnosis and management of colovesical fistulae; six-year experience of 90 consecutive cases. *Colorectal Dis*, 2006; **8**: 347.
2. Golabek T, Szymanska A, Szopinski T, Bukowczan J, Furmanek M, Poczoroznik J, Chlosta P. Enterovesical fistulae: aetiology, imaging, and management. *Gastroenterol Res Pract*, 2013; doi: 10.1155/293/617967.


3. Melchior S, Cudovic D, Jones J, *et al.* Diagnosis and surgical management of colovesical fistulas due to sigmoid diverticulitis. *Journal of Urology* 2009; **182**: 978.
4. Sharma MP, Bhatia V. Abdominal tuberculosis. *Indian J Med Res*, 2004; **120**: 305-15.
5. Bandyopadhyay Sanjay, Das Chanchal, Maity Pranab K, Dhua Debargha, Sarkar Niladri. Isolated Colonic Tuberculosis with Colovesical Fistula. *J Assoc Physicians India*, 2010; **58**: 396.
6. Karamchandani MC, West CF, Vesicoenteric fistula. *Am Jour Surgery*, 1984; **147**: 681.
7. Balachandra Deepak, Nag Hulas Hirdaya, Sakhuja Puja, Barman Sandip. Tuberculosis of Intestine with Concurrent Complex Enterovesical and Enterocutaneous Fistula. *Journal Clinical Diagnostic Res*, 2018; **12**: PD03-PD05.

Lionfish envenomation - a sea bathers' nightmare: A case study at Teaching Hospital Karapitiya

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Introduction

Sri Lanka has coral reefs of high biodiversity. Both Synanceiidae (stonefish - the most venomous reef fish on the globe) and Scorpaenidae (lionfish and scorpionfish - which may cause significant envenomation) families are present in it. The risk of envenomation by them are on the rise due to increased leisure activities at sea following cessation of the long stood terrorist problem in the country. However, there is paucity of scientific reports on such envenomation at Sri Lankan coasts due to poor awareness and knowledge on this envenomation and masking effects of drowning and near drowning. It is important that the medical officers, especially those who are working at the coastal hospitals, should have adequate knowledge on clinical presentation, first-aid, management and prevention of marine envenomation. We are reporting here a detailed analysis of a case of lionfish envenomation.

Case presentation

A 16 year-old otherwise healthy boy has been admitted to the Emergency Treatment Unit, Teaching Hospital Karapitiya (ETU-THK) with a complaint of his right middle finger being stung (Figure 1) by a moving reddish fish. The incident happened when he tried to catch the fish by putting his hand under a coral rock in the sea near Galle Fort.

His immediate complain was intense pain at the site of the sting with a radiating ache towards the axilla. Next, he observed swelling of the ring finger within 15 minutes. The patient was admitted to ETU-THK within 30 minutes of the incident.

On admission, a bleeding tendency assessment test - 20 minutes, whole blood clotting time - recorded negative results and right middle finger pulse was detected by the onsite ultrasonography. Swelling has extended beyond the wrist within four hours of the sting (Figure 2) and he was transferred to a General Surgical unit at THK for further care.

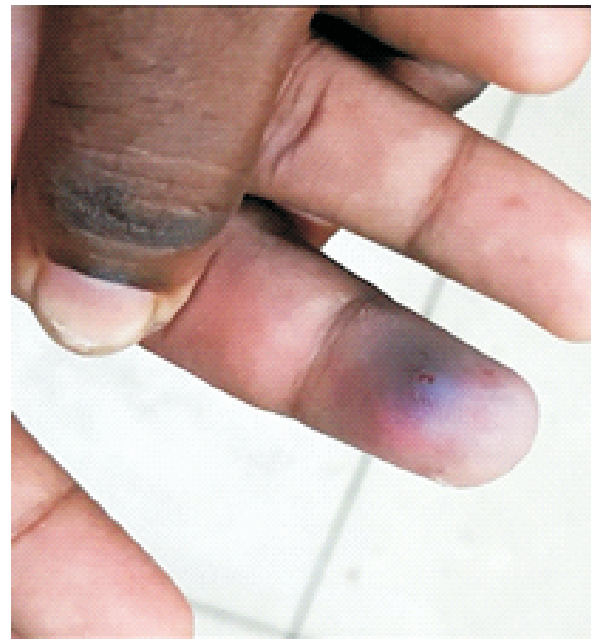
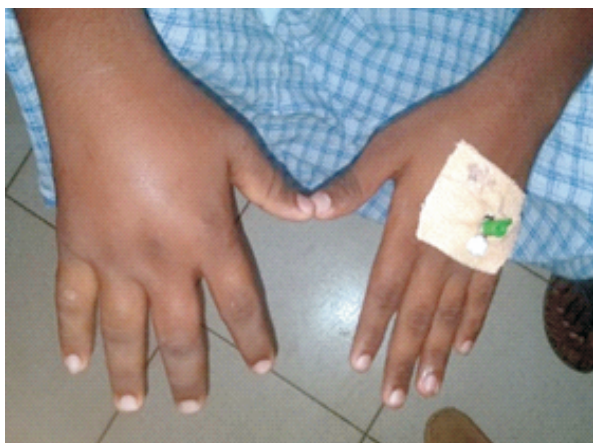


Figure 1: The sting site on right ring finger caused by the lionfish

Summary of investigation results are given in the table 1.

Table 1: Summary of the investigation results

Investigations	Result	Result	Reference range	Comment
	Day 1	Day 2		
WBC	$14.78 \times 10^3/\mu\text{L}$	-	$4.5 \text{ to } 11.0 \times 11^3/\mu\text{L}$	Marginal elevation
Neutrophil	$8.61 \times 10^3/\mu\text{L}$	-	$1.5 \text{ to } 8.0 \times 10^3/\mu\text{L}$	Marginal elevation
Lymphocytes	$4.63 \times 10^3/\mu\text{L}$	-	$1.0 - 4.8 \times 10^3/\mu\text{L}$	Normal
Platelets	$345 \times 10^3/\mu\text{L}$	-	$1.50 - 4.50 \times 10^3/\mu\text{L}$	Normal
Blood urea	22 mg/dL	23 mg/dL	19 - 43 mg/dL	Normal
Creatinine	82 $\mu\text{mol/L}$	55 $\mu\text{mol/L}$	60 - 110 $\mu\text{mol/L}$	Normal
PT	12.8 s	-	< 13.0 s	Normal
INR	1.13	1.23	< 1.5	Normal

**Figure 2:** Swelling of the right hand after four hours of the injury**Figure 3:** Healed sting site after six weeks of injury

The initial pain was managed using an antipyretic (paracetamol) and anti-inflammatory (NSAID) oral medications. Chlorpheniramine was given to reduce the inflammation. Co-amoxyclav and Metronidazole infusions were started and a parenteral antihistamine was continued. Symptoms and most of the swelling of the hand improved within the course of three days. Surgical interventions were not required. Patient was discharged after 5 days of in-ward care. He was given same antibiotics orally for five more days. Patient was reviewed after six weeks in the outpatient department (Figure 3).

Discussion

Patient gave a vague description of the fish which allowed doctors to suspect that it could be a lionfish sting. An immediate exploration by the first author at the vicinity where the incident occurred allowed him to detect and photograph a pair of lionfish and to identify them as *Pterois antennata* (Figure 4).

Lionfish belongs to family Scorpaenidae and consider in class Actinopterygii under order Scorpaeniformes. They are native to Indo-Pacific Ocean, thus found in Sri Lanka as well. *Pterois antennata* (Bloch 1787), *Pterois miles* (Bennett 1828) and *Pterois radiata* (Cuvier 1829) species live in Sri Lankan coral reefs and popular among exotic fish trading.

The lionfish have 18 venomous fins (Figure 5) along the pelvic, anal and dorsal areas primarily for their self-defense. Marine scientists have noticed that they do not use them to catch the prey. Adult lionfish show territorial behaviour and the offspring usually swim slowly around the vicinity searching for new territories and foods. The victims get stung by these fish when the lionfish has not enough time to move away or when swimmers try to touch them. When a spine enters the victim's tissue, the sheath of the spines pressed down and the venom released from the ridges situated along the spines (Figures 6 and 7). Lionfish venom is not usually fatal unless the affected person is drowned due to the pain and paralysis. However, the venom causes severe reactions and may lead to infections if not managed properly.



Figure 4: The Lionfish *Pterois antennata* (Bloch, 1787) at Fort Galle coral reef.



Figure 5: Venomous and non-venomous parts of the lionfish

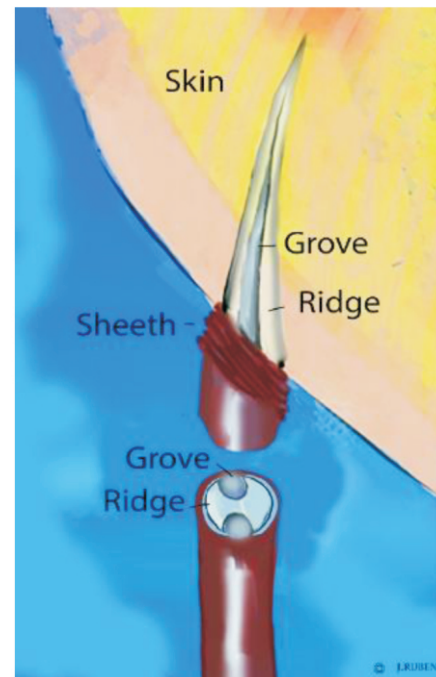


Figure 6: The anatomy and the mechanism of envenomation

Upon entering the tissues, the venom quickly shows its effects. Initial complaint of severe pain is mainly due to stimulation of non-peptidergic nociceptors along with weakness and numbness of the affected limb (1).

Systemic symptoms are not very common in lionfish envenomation. However, it can cause some cardiac symptoms such as hypo / hypertension, tachy / bradycardia and very rarely, fever, cold sweating, syncope, nausea, vomiting, dyspnoea, convulsions and even cardiac failure. Hypersensitivity to the venom may cause anaphylactic reactions, which is seen in repeated envenomation (2). Theoretically, lionfish possesses fatal toxins, however deaths due to its sting has not been reported yet (3).

Lionfish venom induces haemolytic activity and weak cytotoxicity in endothelial cells and myoblasts (4). *In vivo* lionfish venom induces a lesion in the skin probably as the result of a thrombotic effect. Lionfish venom is considered neither haemorrhagic nor myotoxic, but can cause oedema and vascular congestion. Gelatinolytic activity is decreased by EDTA, indicating the presence of metallo-proteinases, both in crude venom and mucus (4).

Although lionfish are venomous and the venom of the fish remains potent for up to 48 hours after the death of the fish, cooked fish is not poisonous due to the vulnerability of venom to heat when cooking (3). Sometimes they can be found in the local fish market after removal of fins to prevent accidental envenomation (Figure 8). However, the lionfish is not a traditional food in our country, and they only come to the market when accidentally caught into the fishing nets.

As saltwater aquariums are not popular in Sri Lanka, lionfish stings not common among local aquarium keepers, which is perhaps more common in the West including USA, Mexico, Brazil etc. (2). In Sri Lanka, the usual community who are at risk includes sea bathers, snorkelers and fishermen. At present the biggest threat is that lionfish has become an invasive species in non-native oceans like Mexican gulf areas where there are no natural predators. Thus hunting lionfish and consuming them as a food is permitted in those countries (2).

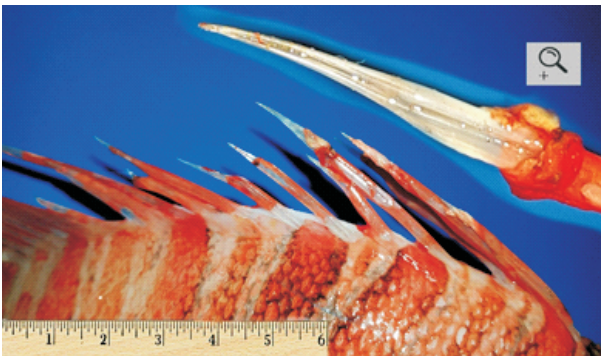


Figure 7: Venomous dorsal spines of a lionfish (dead specimen collected from the fish market)

Treatment of lionfish sting includes removal of visible spines and immerses or sponge the affected area with non-scaling water (45°C). This will relieve the pain by deactivating the venom, however delayed cases need NSAIDs and opioids for effective pain management. Regional anaesthesia is another method of pain relief. However, it should not be combined with hot water immersion due to the risk of burn injuries. Antibiotics can be given to prevent the infections. Tetanus toxoid should be given as a prophylactic measure. An antihistamine is given to prevent allergic reactions. Further, the multiple

exposures to the toxin may cause anaphylaxis therefore, patient should be brought to a place where anaphylaxis can be managed effectively.

In the case reported here, the surgical team was planning to do a wound toilet due to the bluish necrotic skin. However, upon observing the satisfactory progression of the site of sting, decided not to do tissue removal at the fingertip. Tissue removal at the fingertip is challenging as it can lead to disfigurement and functional impairment. Though patient's injury has healed by six weeks, remarkable changes in the texture of the skin like thinning and bulging was observed at the affected site.



Figure 8: Lionfish for sale (Fins removed) at a fish stall near Galle Fort

All photographs and drawings by Janaka Ruben except for the photograph in figure 3 which is by Ekanayaka ST.

References

1. Mouchbahani-Constance S, Lesperance LS, Petitjean H, Davidova A, Macpherson A, Prescott SA, *et al.* (2018). Lionfish venom elicits pain predominantly through the activation of nonpeptidergic nociceptors. *Pain*, 159; **11**: 2255-66.
2. H addad V, Stolf HO, Risk JY, França FO, Cardoso JLC. (2015). Report of 15 injuries caused by lionfish (*Pterois volitans*) in aquarists in Brazil; a critical assessment of the severity of envenomations. *Journal of Venomous Animals and Toxins including Tropical Diseases*, 21; **1**: 8.
3. Rensch G, Murphy-Lavoie HM. Lionfish, scorpionfish, and stonefish toxicity. (2018). *Stat Pearls* [Web accessed on 18.08.2019]: Stat Pearls Publishing; 2018.
4. Kasdan ML, Kasdan AS, Hamilton DLJP. (1987). Lionfish envenomation. *Plastic and Reconstructive Surgery*, 80; **4**: 613-4.
5. Ruben J. (2019). Lionfish at Fort Galle. 2019. [Web accessed on 18.08.2019] URL - <https://youtu.be/u0z2An4TfSs>.