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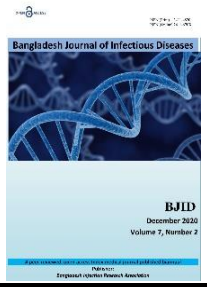

Trends of Mortality and Morbidity due to Ascariasis: A 14-year Analysis in a Tertiary Hospital in Bangladesh

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Abstract

Background: Ascariasis is still a major public health concern and is termed as neglected tropical disease. There are surgical morbidity and mortality due to ascariasis. **Objective:** The general objective of the study was to analyze the trend of hospital admission and mortality from ascariasis at a tertiary government hospital in Bangladesh. **Methodology:** This was a retrospective chart review performed in the department of pediatric surgery at Chittagong Medical College Hospital, Chattogram, Bangladesh from a period of January 2006 to December 2019. Patients of 0 to 12 years of age who were admitted and diagnosed as intestinal or biliary ascariasis were analyzed for yearly trend for admissions, surgeries, and mortalities. **Results:** There were a total of 33,426 patients with various disease admitted and among them 2799 (8.67%) patients were diagnosed as intestinal ascariasis and 375(1.12%) patients were diagnosed as biliary ascariasis. Admission rate for intestinal ascariasis decreased from 15.87% in 2006 to 8.67% in 2019 and that for biliary ascariasis decreased from 1.87% to 0.98 %. The surgical load for intestinal obstruction decreased from 5.20% in 2006 to 1.09% in 2019 among all surgeries. Only one surgery was performed for biliary ascariasis. Mortality rate of ascariasis among all mortalities decreased from 20% to 5%. There was no death from biliary ascariasis. **Conclusion:** Surgical morbidity and mortality from intestinal ascariasis decreased over time but ascariasis is still causing loss of valuable lives. [*Bangladesh Journal of Infectious Diseases, June 2023;10(1):24-30*]

Keywords: Intestinal ascariasis; biliary ascariasis; intestinal obstruction; helminth; children

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Introduction

Ascariasis, caused by A. lumbricoides, is the most common soil transmitted helminthiasis (STH) in the world and about 1.2 billion people are infected by it. School age children (SAC) and pre-school age children (PSAC) are most commonly affected and about 60,000 deaths occur per year[1,2]. In spite of this high numbers, it is still classified as a neglected tropical disease[3]. The World Health Organization (WHO) had aimed to eliminate STH as a public health problem by 2020, and supported countries to

run deworming program. However, it has now extended its program until 2025 with support from governments, Children Without Worms (CWW) and Johnson & Johnson[4].

Ascariasis is endemic in Bangladesh with all 64 districts being infected and deworming program is being going on since 2008[4]. In early days, ascariasis had been a major cause of mortality and morbidity in children mainly due to intestinal obstruction followed by shock, sepsis, or electrolyte imbalance. A previous study conducted in 2011 showed a decreased trend of mortality and morbidity from ascariasis in children signifying the benefits of deworming program[5] The aim of the study is to further analyze the trend of disease burden and mortality from ascariasis in our pediatric surgical ward which is at a tertiary government hospital in Bangladesh.

Methodology

Study Settings and Population: This is a retrospective chart review conducted at Department of Pediatric Surgery, Chittagong Medical College Hospital between January 2006 and December 2019 (total 14 years). Patients below 12 years of age who were admitted and diagnosed as intestinal or biliary ascariasis at this institute during the study period were included. Diagnosis of intestinal ascariasis was made from history of passage of worm, clinical features, visualization of worm bolus in abdominal x-ray or ultrasonogram and finding of round worm during laparotomy. Diagnosis of biliary ascariasis was made by suggestive history with finding of worm in the biliary tree by ultrasonogram or upper gastrointestinal endoscopy.

Data Collection: Secondary data from the departmental records of annual reports, monthly reports, daily statements, operating theatre log, mortality and morbidity records, monthly and annual audits were searched for patients diagnosed and treated as intestinal and biliary ascariasis and cross checked. Individual patient's file was not available for all patients and was not reviewed. Yearly total of all admitted patients, patients with ascariasis, total number of surgeries and surgeries for ascariasis; and total deaths and deaths from ascariasis were analyzed. All causes of intestinal obstructions were recorded and the number and percentage of ascariasis as a cause of intestinal obstruction was analyzed. Year wise data were compiled and compared along these parameters. Data were evaluated to present the yearly percentage of patient bulk, surgeries performed and deaths from ascariasis.

Statistical Analysis: Statistical analyses were performed with SPSS software, versions 22.0 (IBM SPSS Statistics for Windows, Version 22.0. Armonk, NY: IBM Corp.). Continuous data that were normally distributed were summarized in terms of the mean, standard deviation, median, minimum, maximum and number of observations. Categorical or discrete data were summarized in terms of frequency counts and percentages. When values are missing, the denominator was stated. Every effort was made to obtain missing data. Yearly trends were presented as frequency and percentages to follow the trend. No test of significance was conducted.

Ethical Clearance: All procedures of the present study were carried out in accordance with the principles for human investigations (i.e., Helsinki Declaration) and also with the ethical guidelines of the Institutional research ethics. Since this was a retrospective chart review from hospital records and individual patients' files were not checked, consent from participants is not applicable. There was no scope of disclosure of patients' identity. All data were collected anonymously and analyzed using coding system.

Results

During this 14-year duration, a total of 33,426 patients with various disease conditions were admitted in the department of pediatric surgery. Among them 2799 (8.67%) patients were diagnosed as intestinal ascariasis and 375(1.12%) patients were diagnosed as biliary ascariasis, thus the total disease load for ascariasis was 3272(9.79%). The age range for admission in this department is 1 day to 12 years. There was a gradual decrease in the number and percentage of patients with intestinal and biliary ascariasis with time (Table 1).

Table 1: Yearly Distribution of all Admitted Patients and Patients with Intestinal or Biliary Ascariasis

Year	Yearly Total Admitted patients	Intestinal Ascariasis admissions	% of intestinal ascariasis among all admissions	Biliary Ascariasis admissions	% of biliary ascariasis among all admissions
2006	1550	246	15.87	29	1.87
2007	1652	255	15.44	38	2.3

Year	Yearly Total Admitted patients	Intestinal Ascariasis admissions	% of intestinal ascariasis among all admissions	Biliary Ascariasis admissions	% of biliary ascariasis among all admissions
2008	1935	257	13.28	26	1.34
2009	2162	284	13.14	27	1.25
2010	2470	298	12.06	26	1.05
2011	2985	251	8.41	35	1.17
2012	3060	287	9.38	54	1.76
2013	2678	297	11.09	26	0.97
2014	2756	176	6.39	20	0.73
2015	2521	140	5.55	18	0.71
2016	2448	98	4.00	16	0.65
2017	2228	112	5.03	26	1.17
2018	2227	94	4.22	7	0.31
2019	2754	102	3.70	27	0.98
Total	**33426**	**2897**	**8.67**	**375**	**1.12**

The proportions of intestinal ascariasis as a cause of intestinal obstruction decreased over time. Intestinal ascariasis was the leading cause of intestinal obstruction until 2015 and after that it was second to anorectal malformations (Figure I and Table 2).

Table 2: Ascariasis and Other Diseases Responsible for Intestinal Obstruction

Year	Ascariasis	Anorectal malformations	Hirschsprung disease	Intussusception	intestinal obstruction NOS	Bands and Adhesions	Malrotation of gut	Obstructed inguinal hernia Hernia	Jejuno ileal atresia	Others	Total (intestinal obstruction)
2006	246	87	93	33	23	17	15	17	11	9	551
2007	255	135	157	45	72	26	21	24	16	6	757
2008	257	193	153	39	76	59	23	19	6	16	841
2009	284	99	113	33	32	17	15	17	11	19	640
2010	298	201	161	41	56	61	32	12	7	16	885
2011	251	117	69	59	17	5	13	8	10	37	586
2012	287	118	80	41	36	2	12	14	12	29	631
2013	297	125	80	57	34	2	12	9	14	33	663
2014	176	140	84	74	30	5	9	8	9	49	584
2015	140	184	42	55	28	3	9	5	18	31	515
2016	98	128	93	75	36	2	8	6	19	38	503
2017	112	125	99	67	13	2	10	7	14	35	484
2018	94	157	28	35	38	1	3	0	3	14	373
2019	102	136	120	92	81	13	11	14	18	56	643
Total	2897	1945	1372	746	572	215	193	160	168	388	8656

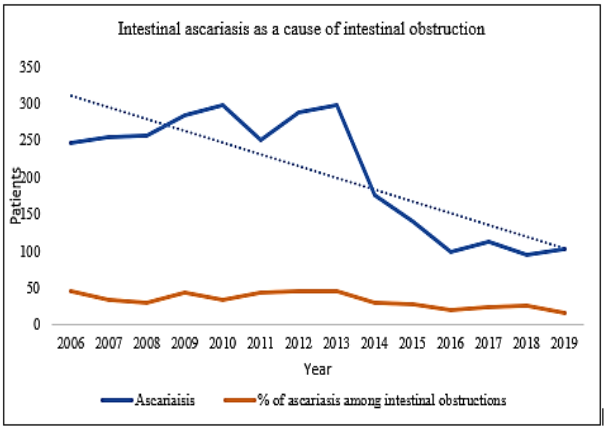

Figure I: Trend of intestinal ascariasis as a cause of intestinal obstruction

During the study period, a total of 27,256 surgeries were done in this department. Among them 8442(30.97%) surgeries were emergency surgeries. The surgical load for intestinal obstruction among all surgeries decreased from 5.20% in 2006 to 1.09% in 2019. Since surgeries for ascariasis are done as emergency procedure, these are a great burden to manage during the after-hours. These load of emergency surgeries for intestinal ascariasis also decreased from 12.78% in 2006 to 3.51% in 2019 (Figure II).

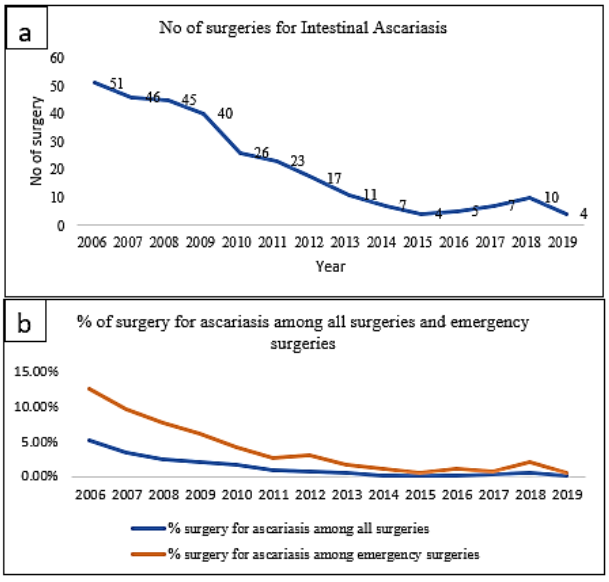

Figure II: Surgeries for intestinal obstruction. (a) yearly number of surgeries for intestinal ascariasis, (b) yearly percentage of surgeries for intestinal ascariasis among all surgeries and among emergency surgeries.

Surgical procedures included intestinal resection anastomosis, ileostomy, enterotomy and removal of worm bolus, milking of worm bolus. Biliary ascariasis was managed conservatively or through endoscopic removal. Only one patient needed exploration of common bile duct for persistent pain with retained worm fragments therein.

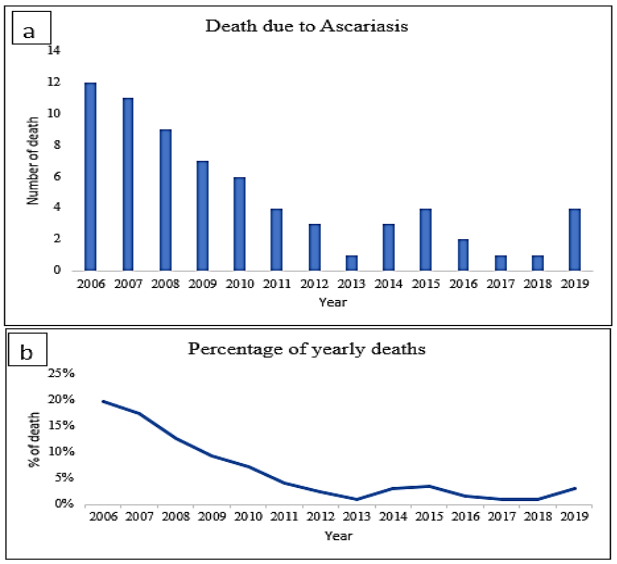

Figure III: Yearly number(a) of deaths and death rates (b) due to intestinal ascariasis.

Intestinal ascariasis persisted to be a cause of death among children. However, the rate of death decreased from 19.67% in 2006 to 3.03% in 2019. There was no mortality from biliary ascariasis (Figure III).

Discussion

Ascariasis is a common public health problem prevalent in about 150 countries in which about 75% are distributed in Central and Southeast Asia[1]. The maximum numbers of children with intestinal ascariasis live in India, followed by Nigeria, Indonesia and Bangladesh[6]. In Bangladesh, ascariasis has always been a public health concern causing a large number of morbidity and mortality. This study shows that there is a decreasing trend in the surgical morbidity and mortality from ascariasis. It can be assumed that national deworming program supported by WHO has a major role in bringing this change.

In Bangladesh, upazilla and district hospitals do not have pediatric surgical departments and these are not well organized in terms of equipment and manpower to perform major surgeries in children. However, it has a very good health care infrastructure and children are referred to tertiary centers for major surgical morbidities[7]. There has been a decreasing trend in surgical admissions and deaths due to ascariasis in children in this study. The number and percentage of ascariasis as a causative factor for intestinal obstruction has also

been decreased. Before 2015, ascariasis was the most common cause of intestinal obstruction, but since 2015 it has been second to anorectal malformations. Baba et al also reported that ascariasis was the most common cause of intestinal obstruction in children in 2009[8]. Intestinal obstruction has been reported to be the most common complications of ascariasis in countries like India, China, South Africa, Kenya and Myanmar[9].

A nationwide school-based deworming program was started in 2008 in Bangladesh, with an aim of regular deworming among 75-100% of school-age children[10]. The aim was to achieve the global target of eliminating morbidity due to STH in children by 2020 in Bangladesh[11]. Deworming was initially observed as national deworming day and later it is observed as deworming week from 2010 and deworming week was shifted from May to April and from November to October from the year 2013. Moreover, Tablet Mebendazole (500mg) is now used for deworming program instead of Tablet Albendazole from the November round of 2012[4]. Despite these long-lasting deworming program, the prevalence is still high in Bangladesh. A study conducted by Benjamin-Chung et al found a 23% to 37% prevalence rate of ascariasis[12]. A multi-stage, cluster-sample, household survey produced equal-probability samples for PSAC and SAC and found a 8.2% and 8.9% prevalence rate respectively[13]. A study found that prevalence in Sirajganj District ranged from 23.4 to 29.1% and was significantly higher than Joypurhat, Chapai Nawabganj, and Rajshahi districts where it ranged from 3.3 to 5.4%[13]. A community survey conducted by Directorate general of health services (DGHS) in 2017-2018 among 9 districts found a 12.5 % prevalence rate. However, prior to the initiation of programmatic activities, a study in 2005 involving plane, coastal and hilly areas found that 79.8% of the children were infected and 43.6% had moderate heavy intensities of ascariasis[4,6]. There has been much improvement of scenario since then. Das *et al* reported a 9.6% prevalence among children in a tea garden area in Darjeeling[14]. Another study reported a 9.6% prevalence in Nepalese children[15]. The condition is worse in Africa where a 49.7% prevalence of helminths was reported in children in Nigeria with 64.4% being ascariasis[16]. In Pakistan, a 66.0% prevalence in children was reported with 45.5% cases being ascariasis[17].

In 2018, over 676 million school-aged children worldwide were treated with anthelminthic medicines in endemic countries which is about 53.0% of all children at risk[18]. Deworming coverage in Bangladesh was reported to be 99.99% in 2018 by DGHS. However, a study found lower coverage rate than reported by DGHS[2]. They also found that, although people have positive attitudes towards deworming program, their level of knowledge regarding STH and mass drug administration (MDA) was variable. They observed some major barriers associated with MDA such as, drug distribution policy, accessibility to schools, poor record keeping, follow-up, and information dissemination. Moreover, inadequate information about population dynamics, rumors about side effects of MDA drugs, insufficient training of drug distributors and poor motivation among stakeholders also adversely affected the compliance of the deworming program[2].

There are both medical and surgical complications of ascariasis. Morbidity from ascariasis is related to the number of worms harbored. Light intensity worm load usually does not cause morbidity. Heavier infections can cause some medical problems and infections of very high intensity (>60 worms) can cause intestinal obstruction that may need to be treated surgically[18,19]. Medical complications include malnutrition, anemia, growth stunting, decreased physical fitness, decreased school attendance, decreased grade attainment, and reduced cognitive development[20]. Ascariasis is also associated with neurological, psychiatric or motor disorders and is a considered a potential cause of hyperactivity, onychophagia and tic disorders[21]. Surgical complications include intestinal obstruction, biliary obstruction, pancreatitis, appendicitis and primary peritonitis. WHO recommended albendazole (400 mg) and mebendazole (500 mg) tablets for deworming programs in children because these are effective, inexpensive and easy to administer by non-medical personnel. Other commonly practiced drugs are levamisole or pyrantel pamoate[19].

From the findings of the study, it can be assumed that morbidity and mortality from ascariasis is decreasing due to the ongoing deworming program, however valuables lives are still lost due to ascariasis. Although not analyzed in this study, it is well known that acariasis is more problematic in low socioeconomic conditions and related to contact with soil and food related hygiene. Improvement of socioeconomic status and health education are necessary to eradicate the problem. WHO suggested that control is based on periodical deworming to eliminate infecting worms, health education to prevent re-infection, and improved sanitation to reduce soil contamination with infective eggs[18]. DGHS has been running the ‘Little

Doctor' program among school students under STH Control Program. through all primary and secondary level of educational institutions for maintaining peer-education in STH control and developing health-related well-being, followed by regular and proper hygiene practices[10]. The goal of the school-based deworming program is to control intestinal helminths among school-aged children of 5 to 12 years and the 2017 to 2021 goal is to eliminate intestinal helminths among children reducing moderate to heavy intensity to less than 1.0% cases[10].

There are six 2030 global targets for STH declared by WHO. These are to achieve and maintain elimination of STH morbidity in pre-school and school age children, to reduce the number of tablets needed in preventive chemotherapy for STH, to increase domestic financial support to preventive chemotherapy for STH, to establish an efficient STH control program in adolescent, pregnant and lactating women, to establish an efficient strongyloidiasis control program in school age children, and to ensure universal access to at least basic sanitation and hygiene by 2030 in STH-endemic areas[18]. If the targets can be achieved, global morbidity and mortality caused by ascariasis should be at a minimal level.

Conclusion

Mortality and morbidity from intestinal and biliary ascariasis have a decreasing trend over the last 14 years. However, it persists and is a major public health concern as it is taking valuable lives. The disease load for intestinal ascariasis reduced from 15.9% to 3.7% over theses years and that for biliary ascariasis reduced from 1.9% to about 1% of all admissions. The surgical load for intestinal ascariasis as a cause of intestinal obstruction decreased from 12.8% to 3.5%. Mortality from ascariasis reduced from 19.7% of annual mortality to 3%.

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None

Conflict of Interest
There is no conflict of interest to any of the authors of this article.

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Contribution to authors:
Chowdhury TK was involved in manuscript writing and data analysis; Chowdhury MTS, Sharmin E, Sayedin A involved in data collection; Farooq MAA involved in revision of manuscript**.**

Data Availability
Any questions regarding the availability of the study's supporti ng data should be addressed to the corresponding author, who can provide it upon justifiable request.

Ethics Approval and Consent to Participate
Since this was a retrospective study, not every study participant provided formal informed consent. Each method followed the appropriate rules and regulations.

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