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Incidence and Predictors of Poor Outcome among Childhood Tuberculosis in the North of Cameroon

Incidence et facteurs prédictifs du devenir défavorable de la tuberculose de l'enfant au Nord Cameroun

Adamou Dodo Balkissou[1,2], Fadil Donkou Raouph[3], Djibril Mohammadou Mubarak[4], Armel Djao Kora[5], Virginie Poka-Mayap[6], Kuaban Alain[7], Eric Walter Pefura-Yone [7,8], Seraphin Nguefack[7,9]

[(1)]Faculty of Medicine and Biomedical Sciences of Garoua, University of Garoua, Garoua, Cameroon
[(2)]Regional Hospital of Garoua, Garoua, Cameroon
[(3)]Regional Hospital of Maroua, Maroua, Cameroon
[(4)]Sub-division Medical Center of Barak, Maroua, Cameroon
[(5)]Baptist Hospital of Maroua, Maroua, Cameroon
[(6)]Jamot Yaounde Hospital, Yaounde, Cameroon
[(7)]Faculty of Medicine and Biomedical Sciences, Yaounde I University, Yaounde, Cameroon
[(8)]Higher Institute of Medical Technology, Yaounde, Cameroon
[(9)]Gyneco-Obstetrical and Pediatric Hospital of Yaounde, Yaounde, Cameroon

Corresponding author:
Adamou Dodo Balkissou
BP 317 Garoua, Cameroon.
Phone number: (00237) 697220022
Email: dodobalkissou@gmail.com

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Mots clés : Tuberculose pédiatrique, incidence, facteurs prédictifs, devenir défavorable, Cameroun.

ABSTRACT

Background. Childhood tuberculosis (TB) has been neglected by TB programs in Sub-Saharan Africa. The aim of this study was to determine the incidence and predictors of poor outcome in children with TB in the North region of Cameroon. **Methods.** It was a retrospective cohort study based on hospital TB registers and treatment TB forms, in all of the 18 functional diagnosis and therapeutic centers (DTC) in the North region. All children aged 0-15years, on anti-TB treatment between 2010-2016 were enrolled. Logistic regression was used to find independent factors associated to poor outcome. **Results.** Of the 668 children included [321 (48.1%) boys], the median (25^{th}-75^{th} percentile) age was 11(6-14) years, with 75.9% children aged >5 years. Pulmonary TB was the most common (62.9%) with 34.3% smear-negative pulmonary TB. Extrapulmonary TB (62.1%) was mostly found in children aged 0-5years. HIV/TB coinfection was 10.3%. Incidence (95%CI) of poor outcome was 4.0 % (2.5-5.5%). Predictors [OR (95% CI)] of poor outcome were: HIV positive children [3.995(1.131-14.112), *p=0.031*], management in peripheral DTC [32.451(4.211-250.099), *p=0.001*], and transferred in patients from a peripheral zone toward a 3^{rd} or 4^{th} DTC category [4.602(1.092-19.386), *p=0.037*]. **Conclusion.** Incidence of poor outcome of childhood TB was quite low in the North region of Cameroon. HIV, peripheral TDC and transferred in patients were predictors of poor outcome. A better management of HIV, retraining DTC personnel and early reference from peripheral DTC would reduce poor outcome among childhood TB.

RÉSUMÉ

Introduction. La tuberculose (TB) de l'enfant a été négligée par les programmes en Afrique Sub-Saharienne. Le but était de déterminer l'incidence et les facteurs prédictifs de devenir défavorable de TB pédiatrique dans la région du Nord Cameroun. **Patients et méthodes.** Il s'agissait d'une étude de cohorte rétrospective, dans les 18 centres de diagnostic et de traitement (CDT) de la région du Nord Cameroun. Tous les enfants âgés de 0-15ans, traités pour TB de 2010-2016 ont été inclus. La régression logistique était utilisée pour rechercher les facteurs indépendants du devenir défavorable. **Résultats.** Des 668 enfants inclus [321 (48,1%) garçons], l'âge médian (25^{th}-75^{th} percentile) était de 11(6-14) ans. La TB pulmonaire était la plus représentée (62,9%) avec 34,3% de TB à microscopie négative. La prévalence de la co-infection VIH/TB était de 10,3%. L'incidence (IC à 95%) du devenir défavorable était de 4,0%(2,5-5,5%). Les facteurs prédictifs [OR (IC à 95%)] du devenir défavorable étaient : La séropositivité au VIH [3,995(1,131-14,112), *p=0,031*], la prise en charge dans les CDT périphériques [32,451(4,211-250,099), *p=0,001*], et les patients transférés d'un CDT périphérique vers un CDT d'une zone de 3^{e}-4^{e} catégorie [4,602(1,092-19,386), *p=0,037*]. **Conclusion.** L'incidence du devenir défavorable au cours de la TB pédiatrique est relativement faible au Nord Cameroun. Le VIH, les CDT périphériques et les transferts sont les facteurs prédictifs du devenir défavorable. Une meilleure prise en charge du VIH, le recyclage du personnel et la référence précoce pourraient réduire le devenir défavorable au cours de la TB de l'enfant.

INTRODUCTION

Tuberculosis (TB) is a major public health problem worldwide and an important cause of avoidable mortality in the general population [1,2]. In 2018, there were 1.1 million pediatric cases, with 205 000 deaths and every 5 minutes, a child died of tuberculosis [3]. Despite its high impact on public health, childhood tuberculosis has been neglected by several National Tuberculosis Control Programs (NTCP) [4,5]. In recent decades, there has been a significant rise in pediatric TB cases and the actual magnitude of childhood tuberculosis TB epidemic is difficult to assess, mainly due

to diagnostic difficulties and non-inclusion of children in most survey [6]. Most children have primary, rather than reactivation TB disease, and as a result childhood TB is considered a « sentinel » event, indicating recent TB transmission [7]. Much more, poor access and delay in diagnosing and initiating appropriate TB treatment in children have implications on child morbidity and mortality.

Hence, TB in children can be used as a good indication of ongoing transmission of TB in the community. The World Health Organization (WHO) in 2016 estimates that around 5% to 15% of total TB cases notification is expected to occur in children and even higher in settings with high burden of TB especially the low and middle income countries like Pakistan, South Africa and Nigeria [1,8]. Indeed TB in children is known to occur mostly among infants and younger children less than 5 years and in situations where the immune system is weakened (immune deficiency, malnutrition, diabetes) [8]. In Ethiopia and Nigeria the therapeutic success of childhood tuberculosis were respectively 85.5% and 83.0%. In those studies, it was observed that poor outcome was especially high among children younger than 5 years of age, who were infected with the Human Immunodeficiency Virus (HIV) or for whom their HIV status was unknow [9,10].

In Cameroon, TB remains a common disease with an estimated incidence of rate of 186 (121-266) per 100,000 population and about 5% of the total TB cases notified in 2018 were children aged 0-14 years [11]. Cameroonian NTCP estimated prevalence of tuberculosis in children respectively 3.4% ; 3.8% and 3.7% in the Center, Littoral and North regions [12]. The NTCP routine surveillance data is important to define its epidemiology and identify predictors of poor treatment outcomes. But, data do not disaggregate and don't reported childhood TB cases in terms of type, site of disease, method of diagnosis and previous treatment history, which make programmatic interventions targeting specific childhood TB cases difficult. Considerable efforts have been made in TB control in the country with the implantation of a network of Diagnostic and Treatment Centres over the entire national territory. However, despite these efforts TB control is still heavily hampered by difficult socioeconomic conditions and HIV. The present study was undertaken to determine the incidence and predictors of poor outcome in children with tuberculosis in the North region of Cameroon.

METHODS

Design and study population

The study population consisted of a retrospective cohort of all TB in children who were put on TB treatment in all the DTCs of the North region between January 2010 and December 2016 (duration 6 years). Patients were included if they were aged 0-15 years and presented with an incident case of TB. Patients with incomplete records, those lost to follow-up prior to commencement of treatment, as well as those transferred to DTCs out of the two regions of the study and those who were diagnosed with rifampicin or multidrug resistant TB were excluded.

Study setting

The study was conducted in all the 18 functional TB DTCs in the North region of Cameroon. In these centres and in accordance with the guidelines of the NTCP, TB in children can be diagnosed as smear positive pulmonary TB (SPPTB), smear negative pulmonary TB (SNPTB) or extrapulmonary TB (EPTB) [13]. Cameroon NTCP guidelines recommend that childhood pulmonary TB (PTB) be diagnosed using a combination of factors, including: history of contact with a PTB patient known to be sputum smear-positive for Acid-Fast Bacilli (AFB) ; suspected TB symptoms and signs ; an abnormal chest radiograph, including pulmonary infiltrates and/or hilar or mediastinal lymphadenopathy ; sputum or gastric aspirates that are smear-positive ; and tuberculin skin testing.

The diagnosis of SPPTB is made for children who have symptoms suggestive of PTB and those who have recently been in contact with a patient known to be sputum smear-positive for AFB through microscopic examination of smears of two sputum or gastric aspirate samples collected on two consecutive days after staining by the Ziehl Neelsen or Auramine technique. One smear positive examination suffices to establish that the child had SPPTB. The diagnosis of SNPTB is established in a child who presents with clinical signs suggestive of TB and a past history of contact with an adult patient known to have SPPTB despite two negative examinations on smear microscopy and the following: no clinical improvement after 10 days of treatment with non specific antibiotics, persistent negative smear results of two new sputum or gastric aspirate samples or examinations and a chest X-ray suggestive of TB. The diagnosis of EPTB is made based on suggestive signs and symptoms complemented by paraclinical investigations depending on site such as analysis of X-rays, ultrasonography, fine needle aspirate, pleural tap, biopsy etc.

All patients diagnosed with TB are further classified as new or previously treated cases (relapse, treatment failure, and return after default). All new cases are treated with a category I regimen for a total duration of 6 months. It consists of the daily administration of rifampicin (R), isoniazid (H), ethambutol (E), and pyrazinamide (Z) for the first 2 months (intensive phase) followed by 4 months of rifampicin and isoniazid (2RHEZ/4RH). Previously treated patients undergo a category II treatment regimen for a total duration of 8 months. It consists of the daily administration of RHEZ and streptomycin (S) for the first 2 months followed by RHEZ for 1 month (intensive phase) and then RHE for the last 5 months (2RHEHS/1RHEZ/5RHE). Treatment in the intensive phase is administered under supervision of the health personnel while compliance to treatment during the continuation phase is assessed by monthly return for drug collection. Antituberculosis drugs are given free of charge.

During the 6 or 8 months treatment period, the sputum or gastric aspirate sample of each child with SPPTB is checked thrice for the presence or absence of AFB by direct microscopic examination. This is done for new cases at the end of the 2 months intensive phase and at the end of the fifth and sixth months of treatment. For previously treated SPPTB cases it is done at the end of the 3 months intensive

phase and at the end of the fifth and eighth months of treatment. In children whose sputum or gastric aspirate smears remain positive at the end of the intensive phase, an additional month of intensive phase treatment is given followed by the continuation phase. For those with smear negative and extrapulmonary forms of TB, follow-up of treatment is mainly carried out clinically, sometimes complimented in some cases by paraclinical examinations such as X-rays, ultrasonography etc.

According to the Cameroonian NTCP guidelines all children with tuberculosis are screened for HIV infection free of charge after informed consent has been obtained from their parents or guardians. This includes detection of anti-HIV 1 and anti-HIV 2 antibodies in the serum with the use of two rapid tests : the determine HIV ½ test (Abbot laboratories, Tokyo, Japan) and the Immunocomb II HIV 1 and 2 Bispot kit (Organics, Courbevoie, France). A patient is classified as HIV positive when the two tests are positive. For discordant test, a confirmatory Western blot test (New Lav Blot, Sanofi Diagnostic Pasteur, Chaska, Minnosta, USA) is conducted. All HIV positive children are started on triple antiretroviral therapy free of charge regardless their Cluster Differentiation (CD4) lymphocyte count, according to National HIV control guidelines.

The outcomes of patients at the end of TB treatment are recorded into one of the following six mutually exclusive categories according to recommendations of the WHO and NTCP guidelines [13]: 1) Cured : treatment completed with a negative sputum smear in the last month of treatment and on at least one previous occasion; 2) Treatment completed: patient who has completed treatment but does not meet the criteria to be classified as cure or failure; 3) Treatment failure: patient who is sputum smear positive at 5 months or later during treatment; 4) Died: patient who dies for any reason during the course of treatment; 5) Lost to follow-up: patient whose treatment is interrupted for two consecutive months or more; 6) Transferred out: patient who has been transferred to another recording and reporting unit for whom treatment outcome is unknown.

Data collection

All TB patients aged 0-15 years enrolled on treatment during the study period in all the DTCs of the North region were identified through a review of all the TB registers and treatment forms. Data extracted for each patient were recorded on a pre-prepared electronic data collection form developed in Epidata version 3.1 (Lauritzen, Denmark). For each patient identified, the following information was extracted from the registers and treatment forms and recorded: age, name, sex and category DTC, type of TB (new or previously treated case), form of TB (SPPTB, SNPTB or EPTB) and HIV status. Information was equally extracted and recorded for each patient on the following: transfer in from other centres, as well as treatment outcomes (cured, treatment completed, treatment failure, death, loss to follow-up and transferred out). A child was considered as having a "favourable outcome" if he/she was cured or had completed treatment and as having a "poor outcome" if he/she had treatment failure, died during the course of treatment or was lost to follow-up.

Statistical methods

Data analysis were performed using the IBM Statistical Package for Social Science (SPSS) version 23 software for windows (SPSS Inc., Chicago II., USA). Qualitative variables were summarised using frequencies and proportions while quantitative variables were represented by the mean [standard deviation (SD)] when the distribution was normal or the median [interquartile range (IQR)] when the distribution was not normal. The cumulative incidence of poor outcome was calculated as the proportion of children with poor outcome. Predictors of poor outcome were identified by comparing, variables of children with poor outcome to those of patients who had favourable outcome. Chi-square test or where appropriate Fisher's exact text was used for comparison of proportions. Student T-test or its non-parametric equivalent was used to compare quantitative data. All significant associated factors of poor outcome identified with a $p<0.10$ were introduced into the same multinominal logistic regression model to identify predictors of poor outcome. A p-value <0.05 was used to characterize significant results.

Ethical issue

For retrospective studies there is no obligation for ethics approval. Nevertheless, ethical clearance from the Institutional Ethics and Research Committee of the Faculty of Medicine and Biomedical Sciences of Yaounde I University, and administrative authorization from the authorities of the North Regional Delegation of Public Health were obtained to conduct the study.

RESULTS

General characteristics of the study population

Of the 13 238 records collected, 12 415 (94.1%) records were adults aged above 15 years. On the 823 (5.9%) pediatric cases, 47 (5.7%) incomplete records and 108 (13.1%) transferred out records have been excluded. Table 1 shows the general characteristics of the study population. Were definitely included 668 patients records with the median age (25^{th}-75^{th} percentile) was 11 (6-14) years, of which 347 (51.9%) female and 321 (48.1%) male. Half (353 records, 52.8%) of the recruitment was registered in the only Regional Hospital of Garoua (unique DTC of 3^{rd} category in the North region). Most of the cases (663 records, 99.3%) were new cases of TB, and retreatment for TB disease was documented in 5 (0.7%) children. Overall, childhood TB contributed to PTB in 420 (62.9%) cases, followed by EPTB in 248 (37.1%) records. In cases of lung disease, SNPTB was found in 34.3% of our study population. For EPTB only 02 (0.8%) records of Pott's disease were documented. HIV serology was unknown in 117 (17.5%) cases. HIV serologies was done on 551 patients, of which HIV was 12.5% positive in 69 patients, with 44 (63.7%) children on antiretroviral therapy. Of the 69 TB/HIV co-infected children, 17 (24.6%) children had SPPTB, 24 (34.8%) children had SNPTB and 28 (40.6%) children had EPTB. All of the 69 HIV-positive children were new cases, with 39 (56.5%) female and 21 (30.4%) children less than 5 years.

Incidence of poor outcome

Of the 668 patients included, outcome was unfavorable in 27 patients with an incidence (95% CI) of 4.0% (2.5-5.5%) and density incidence of 7.3 person-month. Poor outcome was represented respectively by 14 (2.1%) deaths, 12 (1.9%) subjects lost to follow-up and 1 (0.1%) patients who have failed to treat category I. In the therapeutic success hand, 258 (38.6%) cured patients and 383 (57.4%) patients who have completed their treatment.

Factors associated with poor outcome

Table 2 represents the factors associated with the poor outcome of TB after univariate analysis. Patients recruited in the peripheral DTC (96.3%) were more likely to become unfavorable outcome compared to those recruited (45.1%) in the 3rd or 4th category of DTC (p<0.001). The transfer in children (references from a peripheral toward a 3rd or 4th category of DTC in the North region) were associated with the unfavorable outcome (11.1% versus 2.2%, *p=0.027*). In terms of HIV serology, unknown HIV status (33.3% versus 16.8%, p=0,048) and HIV positive status (14.8% versus 10.1%, p=0.048) were statistically associated to poor outcome during tuberculosis.

Predictors of poor outcome

Table 3 shows the predictors of poor outcome after multivariate analysis. Independent associated factors [OR (95% CI)] with poor outcome were: HIV positive children [3.995 (1.131-14.112), *p=0.031*], management in peripheral DTC [32.451 (4.211-250.099), *p=0.001*], and transferred in patients from a peripheral zone toward a 3rd or 4th DTC category [4.602 (1.092-19.386), *p=0.037*].

Table 1. General characteristics of the study population

Variables	Total N=668 (%)	Children 0-5 years, N=161 (%)	Children 6-15 years, N=507 (%)	*P*
Gender				
Female	347 (51.9)	85 (52.8)	262 (51.7)	*0.805*
Male	321 (48.1)	76 (47.2)	245 (48.3)	
Type of DTC				
Private	53 (7.9)	11 (6.8)	42 (8.3)	*0.553*
Public	615 (92.1)	150 (93.2)	465 (91.7)	
Localization of TB				
Pulmonary TB	420 (62.9)	61 (37.9)	359 (70.8)	*<0.001*
Extra pulmonary TB	248 (37.1)	100 (62.1)	148 (29.2)	
TB cases category				
New cases	663 (99.3)	161 (100.0)	502 (99.1)	*0.507*
Retreatment	5 (0.7)	0 (0.0)	5 (0.9)	
HIV status				
HIV positive	69 (10.3)	21 (13.0)	48 (9.5)	*0.253*
Unknown	117 (17.5)	24 (14.9)	93 (18.3)	*0.415*
HIV negative	482 (72.2)	116 (72.1)	366 (72.2)	*1*

HIV: human immunodeficiency virus , TB: tuberculosis, DTC: Diagnostic and treatment center

Table 2. Associated factors to poor outcome for childhood tuberculosis after univariate analysis

Variables	Poor outcome N=27 (%)	Favorable outcome N=641 (%)	*p*
Age			
0-5 years	3 (11.1)	158 (24.6)	*0.107*
6-15 years	24 (88.9)	483 (75.4)	
Sex			
Female	13 (48.1)	334 (52.1)	*0.687*
Male	14 (51.9)	307 (47.9)	
Category of DTC			
3rd-4th category	1 (3.7)	352 (54.9)	*<0.001*
Peripheral	26 (96.3)	289 (45.1)	
Transfer in (reference)			
Yes	3 (11.1)	14 (2.2)	*0.027*
No	24 (88.9)	627 (97.8)	
Localization of disease			
Pulmonary TB	20 (74.1)	400 (62.4)	*0.219*
Extra pulmonary TB	7 (25.9)	241 (37.6)	
Type of patient			
New TB cases	27 (100.0)	636 (99.3)	*>0.999*
Retreatment TB cases	0 (0.0)	5 (0.7)	
HIV status			
HIV positive	4 (14.8)	65 (10.1)	*0.048*
Unknown	9 (33.3)	108 (16.8)	
HIV negative	14 (51.9)	468 (73.1)	

HIV: human immunodeficiency virus , TB: tuberculosis , DTC: diagnosis and treatment center

Table 3. Predictors of poor outcome among childhood TB

Variables	Odd's Ratio (95% CI)	p
Age < 5 years	0.443 (0.125-1.571)	0.207
Male gender	1.203 (0.539-2.688)	0.653
Peripheral DTC	32.451 (4.211-250.099)	0.001
Transfer in (reference)	4.602 (1.092-19.386)	0.037
HIV Status		
Positive	3.995 (1.131-14.112)	0.031
Unknown	1.419 (0.585-3.444)	0.439
Negative	1	

HIV: human immunodeficiency virus, TB: tuberculosis, DTC: diagnostic and treatment center, CI: confidence interval

DISCUSSION

The main objective of this study was to determine the incidence and predictors of poor outcome among childhood tuberculosis in the North region of Cameroon. Information resulting from this work were as follows: the incidence of poor outcome among childhood TB was 4.0%. Predictors associated with poor outcome were: children living with HIV, management in DTC of peripheral and the transfer in patients.

The incidence of poor outcome during childhood TB in our study was lower than those 15.2% of a 2019 systematic review [14], 14.5% of Hailu et al. in Addis Ababa, 13.9% of Ramos et al. in Ethiopia [9,15], and 10.5% of Osman et al. in South Africa [16]. This can be explained by low prevalence of HIV/TB in the North region of Cameroon even in adults. In 2018, Cameroonian HIV prevalence was 5.8% in the South Region compared to 1.1% in the North Region ; while HIV prevalence was 20.3% in South Africa [17,18]. On the other hand, the source of contamination of children is adults with SPPTB and infection rate rise around the ages of school entry [19]. Another explanation would be related to the physico-chemical characteristics of BK, its photosensitivity could have limited the survival time period in the Northern zone. Also, the adherence and/or administration of drugs depends fully on the level of parental control. These differences in prevalence in different communities can be explained by exposure to environmental factors such as climate change, socio-economic, lifestyle and preventive measures [20]. These differences can also reflect the diagnostic difficulties of paediatric TB and poor record keeping in our country, which caused discrepancy between reported cases and the actual number of children suffering from TB.

In univariate analysis, we found no significant difference in therapeutic success with respect to age. Several studies have reported contrary results. Osman et al., found that children under 2 years of age were at significant risk of death [23]. Children under 5 years of age had a highly significant risk of unfavourable outcome [9,21]. The most affected age group of children was 6-15 years old, that represent 507 (75.9%) cases out of the 668 cases included in our study. For Hailu et al., in Ethiopia [9], the major age-group represented was under 5 years old (77.3%). This discrepancy could be explained by the fact that the diagnosis of TB in young children (0-5 years) was difficult and is a challenge for the nurses in the North region of Cameroon. There is also a significant difficulty often due to the immaturity of the immune system, the poverty of cell-mediated immunity. The high incidence of severe forms of tuberculosis, the immaturity of the immune system, the delay of diagnosis due to the poor diagnostic techniques and the high prevalence of deteriorating conditions such as malnutrition in young children, were identified as contributing factors of unfavourable outcome in this age group. Graham et al., in Malawi had also highlighted inappropriate dosage and low drug absorption [22]. Young children would not be to swallow large amounts of tablets, which would contribute to a poor therapeutic future. There was no significant difference in terms of gender and unfavourable outcome. We have no explanation for this similarity. There was also no statistically difference in patient outcomes, with respect to the clinical form of TB like found in the some studies with higher rate of SNPTB and EPTB in children [9,23]. Some studies found a highly significant relationship between poor treatment outcome and SNPTB or EPTB [9]. PTB form was the most represented (62.9%) in our study population, it was distributed as follows: 65.7% of SPPTB and 34.3% SNPTB. Genene et al., in 2014 in Ethiopia had pulmonary representation of 50.5%, consisting of 16.6% SPPTB and 83.1% SNPTB [23]. In South Eastern Ethiopia, Jose et al., had a predominant pulmonary localization and a high SNPTB form 68.2% [24]. In all of these studies the most common clinical form was SNPTB contrary to our study [23–26]. This difference can be explained by the difficulties of diagnosis of SNPTB cases by our staff of CDT of the North region of Cameroon, exclusively made of nurses. Indeed, younger children (0-5 years) are unable to produce sputum and therefore paucibacillary. In addition, there is an increase of positive bacilloscopy cases with age [16]. Our sample consisted mostly of older children (75.9% >5 years) which could explain our results. Retreatment was not associated to poor outcome in our study due to its few number.

Several studies have investigated predictors associated with poor outcome. In our cohort, children referred were independently associated with poor outcome during treatment compared to non-referrals. This could be explained by the problem of proximity and accessibility of roads in the North region, especially if the patient is referred in the rainy season. During rainy season, the roads are inaccessible; parents get discouraged or spend a lot to travel at far distance. With this delay, the child presents at his arrival, a very serious clinical status and bad prognosis. There was a statistically significant difference in treatment outcome with respect to follow-up in a peripheral DTC. Paediatric TB cases treated in a 3rd and 4th DTC category were independently associated with favourable outcome. This correlates the findings in Southern Ethiopia. This unfavourable outcome of children in peripheral areas is a reflection of the lack of qualified personnel, medication, and especially of diagnostic means. In our study, children living with HIV were predictors of poor outcome. This result is similar from several studies [9,16,23,27]. In fact, knowing HIV status is essential for better management of TB. HIV infection is also thought to be associated with multiple opportunistic infections that may complicate the treatment outcome. HIV is therefore an important cause of morbidity and mortality during TB. In our cohort, 551

(82.5%) children were tested for HIV. The proportion of TB/HIV co-infection was 10,3%. This HIV/TB co-infection rate is well below the rates found by Chidubem et al., in Nigeria and Hailu et al., in Ethiopia, with respectively 14.5% and 26.8% [9,10]; by Genene et al., in Ethiopia (28.2%); by Rangsima et al., in Thailand (27.0%); and by Maryline et al., in Uganda (31.6%) [21,23,28]. Routine HIV testing of DTC contributed to the high rate of children tested. However, the low percentage of HIV positive children would be due to the low prevalence of HIV in the North region in Cameroon [12].

Our study has some limitations. The main one is based on the retrospective design. Due to the retrospective nature of this work, additional information such as clinical signs, radiological findings, CD4 base count and its follow-up, distance between DTC and patient's home were missing. These information could be subject to further extensive studies. In addition, the treatment records forms and the registries were kept in poor conditions; direct consequences were the exclusion of several patients and the non-evaluation of the potential factors of poor outcome, such as anthropometric characteristics and nutritional status. Our study could also have memory biases during search for past medical history and follow-up biases, for the subjects lost that will not be contacted anymore. The strengths of our study lie in the fact that, we provide more epidemiological data in a context where paediatric TB is little neglected.

CONCLUSION

Childhood TB is relatively low in the North region of Cameroon. Predictors of poor outcome of childhood TB were: children living with HIV, management in peripheral DTC and referred children. Therefore, we recommend further research in order to have the exact clinical factors, improving the diagnosis and monitoring of children with TB. Much more, a retraining of DTC managers and personnel is necessary to allow better understanding of the risk factors of poor outcome of childhood TB, in order to develop strategies for closer clinical diagnosis, follow-up and reference on time.

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Competing Interests

None.

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