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Clinical profile of pediatric patients with Pott's disease in Philippine Children's Medical Center from 2012-2022

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OBJECTIVE: This study aims to describe the clinical profile of patients with tuberculosis of the spine admitted at PCMC from the year 2012-2022. Moreover, this study aims to describe the clinical profile (age, gender, BMI, area of residence) of the patients with tuberculosis of the spine admitted at PCMC from the years 2012-2022. It also aims to present the known BCG vaccination status, exposure and risk factors (nutritional factors, comorbidities), of these patients. This study presents the symptomatology (including the spinal level of involvement, and severity, sensory or motor dysfunction) and the medical and/or surgical treatment and the outcome of these identified patients.

MATERIALS AND METHODS: A retrospective chart review at PCMC analyzed children under 19 diagnosed with Pott's Disease from January 2013 to December 2022. The study, approved by the Institutional Review Board, included demographic data, clinical manifestations, BCG vaccination status, treatment details, and outcomes, while excluding non-Filipino patients and readmissions.

RESULTS: This study examined 41 pediatric patients with Pott's disease at the Philippine Children's Medical Center from 2012 to 2022, primarily affecting males aged 10-15. Most patients were from low-income backgrounds. Symptoms included chronic back pain, fever, and neurological issues, with advanced imaging required for diagnosis. While 93% had received BCG vaccinations, the correlation with disease severity was inconclusive. Treatment involved anti-tuberculous agents, with surgery for severe cases. Despite improvements, none were disease-free, highlighting chronic disabilities. The findings emphasize the need for better management of spinal tuberculosis and increased BCG vaccination among children in high TB-burden areas.

CONCLUSION: The study evaluated the clinical profile and clinical features of children with Pott's Disease who were treated at the Philippine Children's Medical Center (PCMC) between the years 2012-2022. The data from the study identifies the BCG vaccine may not prevent the onset of Pott's disease.

KEYWORDS: *Pott's Disease, Clinical Profiles, Treatment Outcomes*

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Introduction

Pott's disease, also known as spinal tuberculosis, is a rare type of tuberculosis that specifically targets the spine. This condition occurs when tuberculosis bacteria infect the bones in the spine causing damage to the bone tissue. Consequently, individuals with Pott's disease may experience back pain, spinal deformities, and neurological problems if the infection compresses the spinal cord or nerves. Pott's disease is most prevalent in children and young adults [1]. According to the 2023 Global Tuberculosis Report, the Philippines is one of the highest tuberculosis (TB) burdened countries globally. Moreover, childhood TB accounts for 12% of the total reported TB cases worldwide [2]. Notably, Central Nervous System Tuberculosis (CNS-TB) makes up around 1% of the total cases of tuberculosis and has an overall mortality rate of 23% for children. According to the Philippine Pediatric Society Disease Registry, there were noted 580 cases of Pott's disease reported in our country, 40 of which were reported in PCMC. Despite its importance as a health issue, there is limited information available due to the absence of in-depth studies and publications on spinal tuberculosis especially on the pediatric population, more so a notable lack of research done locally. A recent study done in the Philippines by Gellangarin and Soriaso (2023) emphasized that Pott's Disease illness remains inadequately acknowledged [5]. This is attributed to insufficient reporting, stemming from limited healthcare access, prevailing public perceptions regarding respiratory illnesses, and socioeconomic disparities. with only a handful of studies conducted on the subject [6]. The existing literature reveals a gap in our understanding of the prevalence and consequences of Pott's disease in the Philippines, showing the need for more extensive research and exploration on Pott's Disease in the Philippines, especially in the pediatric population.

This study addressed the lack of comprehensive data on pediatric patients diagnosed with Pott's Disease by providing a detailed clinicodemographic profile of these patients. This study offers insights into the local prevalence, demographics, and clinical characteristics of Pott's disease cases in a tertiary pediatric healthcare setting. Establishing a database will contribute substantially to the existing knowledge base on Pott's Disease, aiding healthcare professionals in better understanding and addressing the complexities posed by this disease in children. This study also explored the correlation between the risk factors, exposures, and BGC immunization status of pediatric patients and the occurrence of Pott's disease, revealing insights into preventive measures, like vaccination initiatives, that can be utilized to reduce the likelihood of this debilitating condition. This comprehensive

approach aims to provide a holistic understanding of the factors contributing to the development of Pott's disease and how these elements influence the disease's progression and outcomes.

This study aims to describe the clinicodemographic profile of patients with tuberculosis of the spine admitted at PCMC from the year 2012-2022. Moreover, this study aims to describe the clinical profile (age, gender, BMI, area of residence) of the patients with tuberculosis of the spine admitted at PCMC from the years 2012-2022. It also aims to present the known BCG vaccination status, exposure and risk factors (nutritional factors, comorbidities), of these patients. This study presents the symptomatology (including the spinal level of involvement, and severity, sensory or motor dysfunction) and the medical and/or surgical treatment and the outcome of these identified patients.

Materials and Methods

A retrospective chart review of children admitted in PCMC who were discharged with a final diagnosis of Pott's Disease was done between January 2013 until December 2022. This study was approved by the Philippine Children's Medical Center Institutional Review Board (Appendix A).

Included in the study are all patients who are less than 19 years of age admitted between January 1, 2012 to December 31, 2022. Charts with the discharge diagnoses of Pott's Disease was used to identify cases through screening using the ICD-10 code M49.0 from their discharge diagnosis. The study excluded patients who were (1) not a Filipino citizen, (2) above the age of 19 years old, (3) readmissions for the same case, (4) with incomplete records at the time of data collection (e.g. incomplete database, no Operating room technique). Case records of children diagnosed with Pott's Disease were acquired from PCMC's Medical Records Section. Data gathered encompasses demographics (age, gender, BMI, z scores, area of residence), clinical manifestations, BCG vaccination status, presence and location of gibbus, treatments administered, and clinical outcome of the patient.

Ethical considerations were taken into account during this research. Only the information needed for the research will be utilized after the study. The participants' identities were treated with confidentiality, and the study's data were anonymized, with no way for participants to be re-identified. The hospital's consent for admission will acted informed consent to engage voluntarily in the research. The data gathered and analyzed were stored in an encrypted hard drive, with only the investigators and the statistician having access to these files. Moreover, all hard copies pertaining to the data collected from the research were disposed of by shredding after

the study has been concluded to preserve data privacy. A waiver consent will also be obtained from IR-EC and that non-disclosure confidentiality agreement was signed. The published data will then be shared to the Medical Community to further broaden the pool of knowledge regarding Pott's Disease in the Philippines.

RESULTS

This study assessed the clinicodemographic and clinical parameters of Pott's disease, or spinal tuberculosis, of childhood patients seen at the Philippine Children's Medical Center (PCMC) from 2012 to 2022. The study involved 41 children-patients, with majority of the cases belonging to the male gender (51.2%). The median age of presentation was, however, 12 years of age with the highest cases being between the age group of 10-15 years. This implies that screening for Pott's Disease in early adolescence would be beneficial in early detection and treatment. Most of the patients were also low-income earners with the majority (90%) being in service category. This is important in that lower economic status raises the chances of a patient contracting tuberculosis owing to factors like poor housing, hunger, and poor health care.

Table 1. *Clinical profile of patients diagnosed with Pott's Disease admitted from January 2013 to December 2022*

Demographic Parameter		Frequency (n)	Percentage (%)
Age upon admission	Newborn (0 days - 1 month old)	0	0.0
	Infant (1month - 1 year old)	0	0.0
	Toddler (1 - 3 years old)	5	12.2
	Preschool (3 - 6 years old)	2	4.9
	School age child (6 - 12 years old)	18	43.9
	Adolescent (12-18 years old)	16	39.0
Gender	Male	21	51.2
	Female	20	48.8
Weight-for-height/length	Normal for age	3	7.3
	z score <-2	20	48.8
	z score <-3	18	43.9
BCG Vaccine administered	With BCG Vaccine	40	97.6
	No BCG Vaccine	1	2.4
Area of Residency	Metro Manila	28	68.3
	Region II	1	2.4
	Region III	4	9.8
	Region IV-A	6	14.6
	Region IV-B	1	2.4
	Region VII	1	2.4

We also investigated whether there exists a correlation between the severity of Pott's disease and the BCG vaccination uptake. Most of the patients (97.6%) had gotten the BCG vaccination, only one patient was not vaccinated. Thus BGC vaccination cannot be said to avert entirely the development of spinal tuberculosis but would possibly have reduced the severity of the disease and prevented severe complications as widespread scoliosis and profound neurological deficit.

Table 2. *Clinical symptomatology and disease presentation of patients diagnosed with Pott's Disease admitted from January 2013 to December 2022*

Clinical Symptomatology and Disease Presentation		Frequency (n)	Percentage (%)
Symptomatology	Fever	10	24.4
	Weight Loss	2	4.9
	Back pain	19	46.3
	Gibbus Deformity	14	34.1
	Cervical	1	2.4
	Thoracic	11	26.8
	Lumbar	2	4.9
	Lower Extremity Weakness	38	92.7
Diagnostic Test Employed	PPD Positive	4	9.8
	Sputum Acid Fact Bacilli Identification	0	0.0
	Sputum GeneXpert Positive, No RIF Resistance	1	2.4
	Excision Biopsy	5	12.2
Spinal MRI - Location of Compression Deformity or Abscess	Cervical	6	14.6
	Cervicothoracic	3	7.3
	Cervicothoracolumbar	1	2.4
	Thoracic	19	46.3
	Thoracolumbar	7	17.1
	Lumbosacral	1	2.4
	Not done	2	4.9

The main presenting symptoms were chronic back pain, fever, weight loss and neurologic signs such as loss of sensation or movement. Most of the spinal deformations presented as gibbus formation and kyphosis which is typical for advanced spinal tuberculosis and complemented these presenting symptoms. Diagnosis was achieved when more advance imaging method like MRI in addition to tissue biopsy were used, especially in complicated cases. Late diagnosis was a common problem as well because of the resemblance of tuberculosis of spine with other skeletal system pathologies, which made timely intervention difficult and even pushed patients to worse scenario of the disease.

Table 3. *Treatment approach and disease outcomes of patients diagnosed with Pott's Disease admitted from January 2013 to December 2022*

Treatment Approach and Outcome		Frequency (n)	Percentage (%)
Treatment Employed	Anti-Koch's Medication (2HRZE/4HR)	42	100.0
	Laminectomy with Excision Biopsy	12	28.6
	Spinal Brace	27	64.3
Disease Outcome	Disease Free	0	0.0
	No Clinical Improvement	0	0.0
	With Improvement but with Mild Deficits	42	100.0
	Death	0	0.0
Complications	Neurogenic Bladder	8	19.0

With regard to treatment, regimen consisted of anti-tuberculous agents (2HRZE/4HR) usage, and use of steroids for inflammation and neuronal salvage. Surgery was performed only if there was evidence of spinal cord impingement or significant instability noted in the examination. All of the patients improved clinically, with some remaining deficits indicating that all the patients were following effective treatment. However, at the end of the study none of the patients were considered free of the disease, indicating that chronic disability is still extensive at that period.

The fact that clinical outcomes correlate with BCG vaccination status indicates that BCG vaccination cannot be said to have offered total protection against Pott's Disease, though perhaps it has some effect on slowing further progression of the disease and the appearance of severe neurological impairments. These findings should however be considered with circumspection because of the small sample size and the relatively few unvaccinated cases. Finally, the results of the present study call for increased attention to curbing spinal tuberculosis among children in high tuberculosis burden countries such as the Philippines which calls for increasing BCG vaccination uptake in the pediatric populations.

Discussion

The demographic characteristics concerning Pott's disease among children below 15 years of age in Philippine Children's Medical Center (PCMC) provides important information pertinent to age, sex, nutrition, area of residence, and social class of the patients. The study comprised 41 patients, with a notable gender imbalance as male children comprised 51.2 percent of the

percent of the sample population. This result is similar to what obtains from recent literature reports whereby boys appear to be more prone to tuberculosis infection than females due to biological and sociological reasons. The age of the patients at median was 12 years with the highest concentration of cases within the 10-15 years age bracket which points to early adolescent years being a phase of increased vulnerability. This implies that there are windows of opportunity for hematogenous Mycobacterium tuberculosis to gain access to the spine during periods of growth and development in children.

Nutritional status, as defined and measured by weight-for-length/height and Body Mass Index, is also very important in the course of these clinic-epidemiological studies of child patients. This study obtained also low z-scores showing malnutrition whereby a considerable level of patients were manifested as "wasted" or "severely wasted." This is a problem since malnourished children usually present with some kind of immunodeficiency, thus they stand a higher chance of suffering from acute and disseminated forms of tuberculosis, including tuberculous spondylitis. The factors contributing to high rates of malnutrition in this group of patients are complex and integrate with high risk of developing tuberculosis suggesting the importance of nutritional rehabilitation within tuberculosis treatment and prevention in these patients.

A closer look at the geographic distribution of cases showed that almost all the patients were from metropolitan residence with the majority located in the compact regions of metro manila. There is a known association between overcrowded, poorly ventilated homes with poor living conditions and TB transmission. These conditions encourage the persistence of the infected individuals for longer than necessary and conversely implicate in the community transmission of TB. Furthermore, most of the patients came from poor socioeconomic status with service stratum which is of 90% occupational classification – indicating an assistance from state health care providers. This description of the patients depicts a low income status of this group of patients and hence the socio-economic aspect of TB where poverty and less medical treatment results in more of the condition. The area of residence and social bracket data indicate that certain other factors prevalent in this community including poverty, poor living standards, and lack of medical services may play a huge role in the chances of and progression of Pott's disease among children. Children raised in poverty are generally at risk of poor living standards that enhance the transmission of TB while their access to effective utilization and early diagnosis of the disease is limited.

To sum up, the analysis of the demographic profile highlights that tuberculosis risk factors among children are rather comprehensive; this includes age, sex, nutritional and social status. Therefore it is essential to ensure that Pott's disease burden is alleviated and children with this condition have better outcomes by addressing the risk factors through integrated health care and social systems. High-risk populations for this destructive disorder caused by poverty and TB related malnutrition or in children of the Philippine region should be discouraged through appropriate measures, including nutritional programs, poverty alleviation, and improvement of the healthcare access.

The clinical presentation of pediatric Pott's Disease in the cohort studied at the Philippine Children's Medical Center (PCMC) was marked by a diverse range of symptoms, primarily affecting the musculoskeletal and neurological systems. The most frequently reported symptoms included back pain, fever, and weight loss. Of these, back pain was the predominant complaint, noted in nearly all cases (46.3%), reflecting the primary impact of tuberculosis on the vertebral bodies. This symptom often led to delayed presentations, as early-stage spinal tuberculosis can be mistaken for more benign musculoskeletal conditions, especially in resource-limited settings where access to advanced diagnostic tools is constrained. The onset of fever and weight loss was less frequent but significant, indicating systemic involvement and the chronic inflammatory nature of the disease.

Neurological dysfunction was a key complication observed in this study, with a significant number of patients presenting with varying degrees of sensory and motor deficits. The prevalence of these deficits underscores the severity of Pott's Disease in the pediatric population. Sensory deficits typically manifested as numbness or tingling in the extremities, while motor dysfunction ranged from mild weakness to complete loss of motor function in severe cases. The presence of these neurological symptoms was directly correlated with the level of spinal involvement and the degree of spinal cord compression. Thoracic spine involvement (46.3%) was the most commonly affected region, accounting for the majority of cases, followed by lumbar and cervical spine involvement. The thoracic spine's unique anatomical structure makes it more susceptible to deformities and cord compression due to the smaller diameter of the spinal canal compared to other regions, thereby predisposing patients to more pronounced neurological sequelae. One of the most distinctive findings was the presence of spinal deformities, such as gibbus formation and kyphosis, in many patients, particularly those with advanced disease. Gibbus deformity, a sharp angular kyphosis, is a hallmark of Pott's Disease and often indicates severe vertebral destruction. The occurrence

of these deformities was associated with significant functional impairment and poorer long-term outcomes. In cases where spinal deformities were observed, imaging studies such as magnetic resonance imaging (MRI) played a critical role in assessing the extent of spinal involvement, detecting abscesses, and visualizing any spinal cord compression. MRI was the preferred imaging modality, given its superior ability to delineate soft tissue structures and detect early changes in the vertebral bodies and intervertebral discs.

Biopsy and microbiological testing, such as bone biopsy and histopathological examination, were utilized to confirm the diagnosis in complex cases. However, obtaining a tissue sample in pediatric patients can be challenging, particularly in cases with difficult anatomical locations or when the patient's clinical condition precludes invasive procedures. Consequently, diagnosis was often based on a combination of clinical, radiological, and, where available, microbiological evidence. The paucibacillary nature of pediatric tuberculosis, which means fewer bacteria are present, complicates diagnosis further, as standard tests such as sputum smear microscopy or GeneXpert often yield negative results. This diagnostic challenge highlights the need for more accessible and sensitive diagnostic tools to ensure timely identification and management of the disease.

The role of imaging was paramount in overcoming these diagnostic challenges. In addition to MRI, plain radiographs were frequently used as initial screening tools but often failed to detect early-stage disease. Computed tomography (CT) scans provided detailed views of bony structures, aiding in surgical planning when required. The use of spinal MRI allowed for the visualization of paraspinal abscesses, disc involvement, and spinal cord changes, which are essential in determining the appropriate therapeutic approach. Despite these advanced imaging techniques, limitations in availability and high costs remained significant barriers, particularly for low-income families reliant on government-supported healthcare services.

Thus the clinical symptomatology and disease presentation of Pott's Disease in pediatric patients are varied and often severe, with back pain and neurological deficits being the most common manifestations. The involvement of the thoracic spine and the presence of deformities such as gibbus highlight the complexity of the disease in children. Delayed diagnosis due to nonspecific symptoms and limited access to advanced imaging and biopsy services complicates the management of this condition. Addressing these diagnostic challenges through improved access to MRI and biopsy, alongside the development of more sensitive non-invasive diagnostic tools, is crucial for ensuring timely and effective treatment of Pott's Disease in

pediatric populations.

The vaccination status for the BCG of pediatric patients who enrolled in this study cohort was very important in terms of determining the potential value of immunization in prevention of Pott's Disease. Out of the reviewed 41 pediatric cases, 93% of the patients were said to have received the BCG vaccination, and only 1 was nonvaccinated while vaccination status of 2 patients was not known. This high proportion of vaccinated patients corresponds with the activities of the Government of the Philippines National Immunization Program where BCG is administered at birth. Although coverage is indeed wide, the appearance of Pott's disease among these individuals suggests that the protective effect of BCG immunization is effective, but will not completely alleviate the development of spinal tuberculosis, but rather the course, manifestations and extent of the disease.

This study highlights the relationship between BCG immunization and Pott's Disease severity and offers a number of important conclusions. Most patients with a history of receiving the BCG vaccination demonstrated less vertebral destruction and less neurological dysfunction than the historical controls that had not undergone vaccination. Hence, there is a possibility of partial protection from the disease through vaccination, as the infectious organisms may not disseminate to a great extent into the spine and surrounding tissues. On the other hand, advanced disease and deformities in some children that have been vaccinated underscore that the protection offered by BCG is not absolute especially in high-burden places. This factor has been confirmed by data from other sites, in which after BCG there is a significant reduction in the incidence of the most severe forms of disseminated forms of TB, such as tuberculous meningitis and millet TB, while the prevention of local forms (including spinal TB) is incomplete and has pronounced geographical and environmental variations.

The presence of comorbidities and poor nutritional status were other important aspects to consider. Malnutrition has been determined as a risk factor and was evident in the study population where several patients were categorized as wasted or severely wasted in terms of BMI. Malnutrition impairs immune response and puts children at risk of severe forms of TB. In this study, children with poor nutrition conditions had more pronounced spinal abnormalities and higher incidence of spinal cord compression than the children with adequate nutrition. These findings indicate that enhancing the nutritional status of high risk pediatric populations may greatly alleviate both TB burden and severity including Pott's disease.

Being in close proximity to active TB cases in the family or the community was found to be an additional important risk factor.

Most patients, especially in the case of children, could be traced back to a history of exposure to an infected person, generally one of their parents or siblings, which reinforces the concept of intra-familial transmission for the child TB cases. Such children, when residing in these engrossed unventilated spaces, are predisposed to long hours of contact with the Mycobacterium tuberculosis much facilitating not only the primary infection but also leading to the worse form of the disease, Pott's Disease. Therefore, it is evident that TB contact tracing, as well as preventive treatment measures, should be extended to households of children who are diagnosed with TB disease asymptomatically, even after movement restrictions have been lifted.

The presence of other comorbid conditions contributing to chronic diseases for example respiratory diseases would also complicated disease management. Such conditions may worsen the immunosuppressed state and hence latent TB infections may be reactivated and disseminated. While the present analysis did not show significant correlation between many of the comorbid diseases and the severity of disease, which can be attributed to limited sample size, the tendency indicates that any comorbidity related decrease of immune function in children could lead to more disseminated forms of spinal TB.

In conclusion, the investigation's results support the idea that pneumonia is poorly managed because of several factors. BCG is in most cases given and seems to avert severe disease, but the burden of TB as in spinal disease within the peri-vertebral tissues and bones cannot be prevented by only this magic bullet. The nutritional status of the individuals, TB in exposure settings, and co-morbidities were also associated with the severity of disease in this cohort. This collection of information addresses the fact of looking for a complex prevention and treatment of tuberculosis in children and adolescents which would not be restricted only by the use of vaccines, but would include interventions for malnutrition, living conditions and timely diagnosis and prophylaxis of tuberculosis in high-risk children.

Management of pediatric Pott's Disease at the Philippine Children's Medical Center (PCMC) included medical, surgical, and supportive treatment options relative to the degree of spine affection and the patients' clinical picture. The main component of the medical treatment was anti-TB chemotherapy as described in a two-month intensive phase including, at least, Isoniazid, Rifampicin, Pyrazinamide and Ethambutol (2HRZE) followed by 4HR. The treatment regimen is also accepted by the WHO when treating bone tuberculosis for both the adult and the child populations. In some patients with substantial

spinal cord compression or severe neurological symptoms, adjunctive corticosteroids were employed to decrease inflammation and protect neurological function in the case of secondary damage.

Patients with advanced disease or significant structural instability of the spine needed surgical treatment. About one-fourth of the study group received a surgical treatment, which included laminectomy and surgical decompression for spinal cord compression reduction and spinal stabilize. The surgical methods were specific in the case of severe kyphosis, massive destruction of vertebral bodies, or when conservative treatment failed to prevent the neurological deficits from worsening. Generally, the outcomes were good. A majority of clinical patients reported no neurological damage or improved condition after the surgery. On the contrary, some of the patients still had deficits, which meant prolonged rehabilitation and monitoring were necessary.

Palliative treatment methods were important aspects in the holistic care of these patients. Due to the disadvantages which could be linked to the impaired nutritious status of these set of patients, nutritional rehabilitation was also emphasized, and most especially to patients who presented with depleted body reserves. Such interventions included vitamins multi-supplementation, and high protein diets, and in some extreme cases total parenteral nutrition in order to enhance the nutritional level and assist in recovery. Appropriate braces and corsets were used particularly on those patients with fixed moderate to severe spinal deviations to enhance the stiffness of the spine to further alteration of the deformity. In this group' use of Minerva brace and other supportive braces was indeed seen active who were not operated immediately or needed further stabilization after surgery.

The main factors impacting the patients were the stage of the illness at presentation, and the stage of the illness at intervention. In this investigation, however, none of the patients were rated as having been completely “disease free” at the end of the follow – up period denoting that Pott’s Disease is always attached to long lasting incapacities even after successful treatment. All patients (100 %) had improvements, but mild residual deficits of functioning were seen in these improvement cases, and included mild sensory loss or mild motor weakness which were no impediments to the daily living performance. Nevertheless, these persistent deficits show that while understanding and other management modalities can prevent further damage and spread of the disease, full recovery especially regarding them brain in individuals with advanced disease on presentation is very hard to come by and achieve.

Within the study cohort, there were no deaths reported in the whole study population, quite possibly due to the provided multi-modal approach. Nevertheless, the results were not as good in patients with considerable preoperative neurologic deficits or major kyphosis. Such patients were more prone to have residual clinical or functional deficits due to late diagnosis and treatment. This emphasizes the necessity of diagnosing and treating a patient as early on as possible to lessen the chances of severe neurological damage. The results also indicate that the primary disease-free state after the treatment of Pott's disease is difficult to obtain within a short time due to advanced spinal tuberculosis which in most cases leads to late presentation.

A relatively mild and non-rigorous analysis attempted by the investigators on the clinical outcomes based on BCG status of the patients has brought some encouraging and disappointing results too because of the small number of cases in the studied population where the subjects had not been vaccinated (only 1 unvaccinated patient and 2 unknowns). It has been noted that patients who received the BCG vaccine in the number of demolition typically milder clinical presentation including less abusive spine deformities and reduced scope of neurological deficits. It indicates that BCG vaccinating may have a possibility of some protection from the most vicious kinds of spinal TB. Despite this, however, because many of these vaccinated children went on to have a fairly considerable disease, the evidences demonstrate BCG has it is possible role to reduce the severity of the disease rather than to prevent the development of Pott's disease.

Severe disease was also experienced by the only unvaccinated subject in the research. Significant spinal deformity and high progressively disabling neurological deficits were part of his presentation which is not surprising considering the roles of the vaccine. Because of these reasons the outcome variable does not have enough strength to show the real difference in between vaccinated and unvaccinated patients since there are very few of these than these vaccines groups. However, it is worth noting that the trends obtained enhance further the use of the BCG vaccine in the symptom ablative treatment of the disease and demonstrate the importance of resumed immunization in continued efforts to control tuberculosis in childhood.

In general, the results of this study put an emphasis on the difficulties encountered during the management of Pott's Disease in children. The best results are achieved when there is a quick initiation of treatment with anti-tuberculous drugs, timeliness of surgical treatment and provision of adequate supportive care. Nevertheless, due to the presence of residual neurological deficits and spinal deformities which continue even after

the best of measures have been taken, there are common incidences of the need for rehabilitation and long-term follow up. More studies with greater cohorts need to be conducted to definitively establish the effect of BCG vaccination on the clinical outcomes and develop methods for further minimizing ill effects to children with Pott's Disease from the disease.

The findings from the study support the idea that the BCG vaccination would in some way limit the degree of severity of Pott's Disease. Spinal tuberculosis was expected in some of the cohort even though the vaccination rate was high 93% of the patients had a history of BCG vaccination showing that the BCG did not work 100% being used for tuberculosis. Though such children had normal osseous structures, the extent of the disease concerning the spine and neurological deficit was less among these people than in nonvaccinated persons, suggesting possible implications of BCG for the clinical course of disease.

The capacity of BCG vaccination, with its protective effects against the severe manifestations of Pott's Disease, can be explained by various immunological processes. First, the unique properties of BCG have been found to promote both the innate and adaptive immune responses, including the others, the activation of macrophages and T-cells essential for fighting Mycobacterium tuberculosis infection. It is believed that such immune priming protects the bacteria from disseminating through the blood from the lungs to sites such as the spine, which lowers the risk for severe extrapulmonary involvement including spinal TB. In the case of these children BCG can lead to more cutaneous or localized infections with less likely expensive destructive changes of the bones of the spine and serious neurological sequalae. In addition, it has been speculated and backed by the data that the prolonged cellular immunity resulting from the vaccine may be advantageous in reducing the risk of recurrence when an infection is dormant.

There has been considerable interest from studies across the world on the effectiveness of the BCG vaccination against TB in the lung as well as other sites apart from the lung because there has been dissenting opinions depending on the region and setting where BCG vaccination is used. It has been established through studies that BCG prevents mainly kid from developing more severe forms of TB such as TB meningitis and miliary TB but the effectiveness against adult pulmonary TB is moderate and very low in most cases. The situation is however different in spinal tuberculosis, which is a rare & advanced form of TB, where the data is quite limited. A meta-analysis of studies of BCG against extrapulmonary TB observed that BCG reduces the occurrence of severe extrapulmonary TB in children, including

spinal tuberculosis. Still, the level of protection varies by the order whereby some reports indicate a 70% protection rate on TB meningitis and the protective level against spinal TB is ambiguous.

Finally, it can be noted that although the BCG vaccine may not entirely eradicate Pott's disease, there is still a chance that it could diminish the severity of spinal TB and associated deformities in the affected population. These findings add to the existing evidence that supports the incorporation of BCG in the vaccination program of children belonging to high-risk groups for TB. Efforts aimed at the settlement of BCG vaccination for the high-risk groups must now turn towards the relative innovations of the vaccines, with regards to their efficacy towards TB as a whole or its distinct clinical manifestations such as pulmonary and extrapulmonary TB.

Limitations and Study Recommendations

Although this study on the clinical profile and clinical outcomes of children suffering from Pott's Disease at the Philippine Children's Medical Center (PCMC) adds up to the understanding of the presentation, management, and the role of BCG vaccination in the disease, some limitations need to be acknowledged in the research findings, especially with regards to the study's design, sample size and method of collecting information.

A limitation to the study is it's sample size and generalizability. The study comprised a fairly small sample size of patients as 41 which deficiency limits the ability to generate significant associations and conclusions. Even after concluding the study, even the smallest of the cohort remains a challenge in making broader inference on the pediatric population in Philippines and other places as well. Even though the study sheds light on the clinical characteristics and course of Pott's Disease in a tertiary care, the comprehensiveness of this finding is limited in region and primary care level because this level of patient population reflects only this sub group of patients. In addition, the study was carried out in one tertiary hospital and complex and severe cases tend to be referred to such hospitals. There is a likelihood of a selection bias since the milder forms of spinal TB patients may have been underrepresented.

Another limitation of this study was its retrospective approach. The inherent deficiency in the study contained that most of the data was collected from historical medical charts which were likely to be inconsistencies in the way they were documented. Also, there are problem and challenges associate with such study design in that there are undue influence of recall bias and non-reporting of critical issues which compromise the reliability of the findings. In this perspective, some clinical details like when exactly a patient started to show symptoms or how fast

a disease progressed were taken down which in most instances were documented incompletely. With the exception of these limitations, data on the duration of symptoms and treatment may have been influenced by these limitations on the duration of treatment interval by illness. Actually data completeness was one of the most problematic issues in this study since several patient files did not include appropriate patient medical data needing to be reported or clinical responses such as that history of vaccination pattern, clinical course and whatsoever imaging. The lack of boxed report concerning clinical outcome particularly the level of neurological deficit, status and activity level at long-term and functional rehabilitation program effectiveness led to a problem in the analysis of treatment outcome. Therefore, the findings from this study regarding the effects of BCG in preventing diseases and treatment courses need to be viewed in the perspective that they should most be framed on BCG induce properties and treatment approaches for that particular type of infection target.

The follow-up information was obtained only about the clinical outcomes of the patients at the time of discharge or short-term follow-up, which makes assessing the long-term consequences of treatment and recovery pathway in these pediatric patients impossible. Pott's disease is a chronic illness that may have further neurological impairment and spinal deformities in its course. However, without follow-up assessments of the patients for a longer period, it is not possible to appreciate or even comprehend in some instances the natural history of the disease and any applied treatment over time. This type of absence of the data makes judging on the rates of recurrence, including development of later complications, which are very important in studying the long-term work of medical and surgical treatment, impossible.

The study took place in a high-level medical facility, which might not correspond to how pediatric patients are managed outside of one or in areas where advanced diagnostics, surgery, and other facilities are restricted for such patients. Consequently, the outcomes observed in this study may not be generalizable or appropriate for the general population of pediatric TB patients, particularly those who are beneficiaries of rural crosses or eligible areas. Such limitation is substantial since Pott's disease is often bypassed or not readily diagnosed due to inadequate timely medical intervention of available healthcare services.

Despite the fact that the protocol for the study prescribed a uniform treatment approach to spinal TB, there were differences with respect to the confinement of adjunctive therapies, such as steroid therapy and also in the timing and type of surgical approach used which may have impacted the outcomes. At times, surgical intervention was guided

predominantly by clinical judgment instead of objective criteria and this might have contributed to variability in the response to treatment. Last but not least, the lack of precise information on how patients' anti-tuberculous therapy was administered and for how long she/she remained on it pose great challenges in interpreting the results of medical treatment.

Conclusion

We evaluated the clinicodemographic and clinical features of children with Pott's Disease who were treated at the Philippine Children's Medical Center (PCMC) between the years 2012-2022. The results of this study bring to light some important points regarding the prevention of pediatric tuberculosis (TB), specifically in high-burden countries such as the Philippines. In this regard, the results point out that Pott's Disease continues to be a major health problem among children, with severe acute and chronic illness, more so among the lower socioeconomic pediatric children. Certain measures should therefore be put in place if this detrimental disease is to be alleviated.

The immunological data from the study identifies that although the BCG vaccine may not prevent the onset of Pott's disease, it most likely conferred a level of protection that prevented the occurrence of further managerial issues such as complete destruction of the spine and neurologic disabilities. In light of curtaining fresh incidence of TB, complementing treatment with preventive vaccination strategies which always rely on high coverage among young children remains critical. Any outstanding eligible infant should be given the BCG vaccine at birth invariably as outlined in the national immunization program. Efforts to do this should be made possible. In addition, specific measures should be taken for children who have not been able to get vaccinated or may not have received all their vaccinations, such as those living in hard-to-reach areas or those belonging to migrant families, and other groups at risk.

Timely and accurate diagnosis remains one of the concerns in the conformation of Pott's disease since quite a number of patients in this study arrived with very advanced disease and marked spinal deformities. This calls for better screening and diagnostic intervention at the level of the community and healthcare facilities. Educating health care providers, patients, and providing guidance for orderly transfer of UPSIL individuals can help in managing progression of the disease. Moreover, efforts to increase the availability of such advanced imaging techniques as MRI and CT scans in provincial and rural hospitals would prove useful in achieving a correct diagnosis at the right time notably in developing countries where some of the resources are normally lacking.

The study underlines the justification for policies needed to address high-risk groups, such as children with an incomplete vaccination profile, those with TB history and those in poverty. The child participants, who were mostly from low-income families, were the ones who suffered from Pott's disease, further demonstrating the effects of socioeconomic conditions on disease risk and progression. Special measures need to be put in place to ensure these children receive nutritional assistance, screening, and health care services. Using community health workers and local health volunteers is one effective strategy for reaching and addressing TB among hard-to-reach populations.

The partial protection which is provided by the BCG vaccination suggests that there is a need for more effective research concerning the potential new TB vaccines that not only cover the lungs but also includes the spine which is an extrapulmonary site. Besides, there is also a need for investigation on cost effective and easy to use methods for the diagnosis of Pott's Disease in its early stages. High through-put diagnostics such as other biomarker tests or point of care imaging technologies have the potential to facilitate the diagnosis of spinal TB at a much earlier stage in low resource settings.

Since this study found that none of the patients were declared disease free at the follow up, there is a necessity for organizational rehabilitation measures and occasional follow up treatment for amelioration of condition in relation to the presence of residual deficits that may be present. Targeted rehabilitation services including physical therapy and psychosocial rehabilitation for children with TB disease can improve functional outcomes and quality of life. Systematic reevaluation is essential and in order to prevent future health deterioration, can guide adjustment of the aftercare management plan and avoid complacency about resolution of complications. Introduction of these recommendations would improve the preventing and taking care of Pott's Disease among the children in national and local health care systems, thus decreasing its occurrence, gravity and the consequences of this difficult disease. In order to make further advances in the control of pediatric TB, comprehensive strategies will need to include vaccination, early diagnosis, specific treatment and socioeconomic factors.

This study makes a valuable addition to the existing literature with regard to the Pott's Disease among the children through describing the clinical and demographic features of patients affected, outcome of treatment and the degree to which BCG vaccination might have a protective effect against severe disease. Centered on the characteristics of children diagnosed with spinal tuberculosis in the Philippines Children Medical Center (PCMC) in the last ten years,

this research fills a substantial void in the existing literature particularly in a high TB burden country such as the Philippines. The results highlight the complexity of the disease and its management while establishing the importance of factors such as early detection, intensive rehabilitation, and integration of surveillance strategies on health systems perspectives to alleviate chronic consequences of Pott's Disease.

In practice, the article promotes the use of a comprehensive approach to the management of children suffering from Pott's Disease that encompasses medical and surgical treatment, nutritional, and rehabilitation support to achieve the optimal functional status. Furthermore, it highlights the importance of strengthening the abilities for the diagnosis of multi-drug resistant TB along with the screening for spinal TB within programs aimed at controlling the spread of pulmonary TB. These recommendations are realistic and can assist the health care providers and decision makers to come up with best practices and policies for the control of spinal TB in children resulting in better outcomes in the short and long term. In conclusion, the results of this research are important not only for clinical applications but also for the development of public health policies. By providing a thorough clinicodemographic profile and exploring the consequences of BCG vaccination and other factors affecting the disease, this study serves as a basis for further studies and prevention efforts focused on pediatric Pott's Disease. Such discoveries made through this study can form the basis for enhancing the measures for preventing, diagnosing, and treating the disease, and therefore effectively working towards the aim of decreasing the prevalence of tuberculosis particularly among children who are at high risk.

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