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Bone and Joint Manifestations in Insulin Dependent Diabetic Children

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Abstract

This study was carried out on 94 diabetic children in the pediatric Department of Zagazig University Hospital. All children were subjected to full history, clinical examination, plain x-ray of the vertebrae and joints and full laboratory investigations. Osteoporosis was present in 29.79% of diabetic children being the most common manifestation in our study. Its incidence was more common in males, increased in older children and had unstable correlation with the duration and severity of diabetes. Carpal tunnel syndrome was present in 12.76% of diabetic children and its incidence was more common in females. It was common above the age of 15 years and positively correlated with the severity of diabetes. Trigger finger was present in 5.3% of diabetic children and its incidence was more common in males above the age of 15 years and was positively correlated with duration and severity of diabetes. Cheiroarthropathy was present in 4.25% of diabetic children and its incidence was more common in males, and positively correlated with severity of diabetes. We also suggested a greater influence of patient's age than diabetes duration on the development of cheiroarthropathy. Dupuytren's contracture was present in 3.1% of diabetic children, more common in females, occurred in older children (11-13 years) and its presence depended upon the duration and severity of diabetes. Periarthritis of the shoulder was present in 2.12% of diabetic children, more common above the age of 15 years and dependent on the severity rather than the duration of diabetes. Lastly osteolysis, neuroarthropathy and diffuse idiopathic skeletal hyperostosis were not detected in our diabetic children.

Introduction

DIABETES mellitus is considered to be the most common endocrine / metabolic disorders of childhood and adolescence with important consequence on physical and emotional development [1].

Patients with diabetes mellitus develop many bone and joint changes like acro-osteolysis, osteopenia, charcot joint, trigger finger, periarthritis of the shoulder, dupuytren's contracture, carpal tunnel syndrome, diffuse idiopathic skeletal hyperostosis, limited joint mobility and co-existent osteomylitis. These changes have been attributed to proliferation of connective tissue, neuropathy or vascular insufficiency [2].

In this study we do attempts to establish the association of these features with diabetes mellitus in childhood and to find the incidence in diabetic children giving attention to variables like age, sex, duration and severity of illness.

Material and Methods

This study was carried out on 94 children suffering from insulin Dependent diabetes mellitus (IDDM) with age ranging from 3-18 years in Pediatric department of Zagazig University Hospitals. Patients were classified into 3 groups:

First group: included 60 controlled IDDM children.

Second group: included 16 poorly controlled IDDM children with random blood glucose level > 300 mg% but without the manifestations of diabetic ketoacidosis (DKA).

Third group: included 18 children with DKA.

Also 100 nondiabetic children matched for age and sex were included in the study as a control group.

All studied cases were subjected to the following:

1. Detailed history taking and clinical examination including the musculo-skeletal system as well as other systems of the body.
2. Plain x-ray of the vertebral column and joints.
3. Random blood glucose level by enzymatic method [3].
4. Serum inorganic phosphorus [4].
5. Serum calcium level [5].
6. Serum alkalinephosphatase activity [6].

Results

Results are shown in tables (1-7).

Discussion

A variety of musculo-skeletal disorders occurred more in diabetes than in normal population [7].

Our study showed that osteoporosis was present in 29.79% of diabetic children being the most common manifestation in

Table (1): Percentage of Bone and Joint Manifestations in Diabetic (94 Ccases) & Control Children (100 cases).

Bone & Joint Manifestations	Diabetic Childern	Control Children
Osteoporosis	29.79% (28 out of 94)	0%
Carpal tunnel syndrome	12.76% (12 out of 94)	0%
Trigger finger	5.3% (5 out of 94)	2% (2 out of 100)
Cheiroarthropathy (limited joint mobility)	4.25% (4 out of 94)	0%
Dupuytren's contracture	3.1% (3 out of 94)	0%
Periarthritis of the shoulder	2.12% (2 out of 94)	0%
Bicipital tendinitis	2.12% (2 out of 94)	0%
Osteolysis	0%	0%
Charcot Joint	0%	0%
Diffuse idiopathic skeletal hyperostois	0%	0%

Table (2): Laboratory Data in Diabetic Childern Compared with Control Childern.

Mean + SD	Diabetic Childern			Control children
	Controlled	Uncontrolled		
		With DKA	Without DKA	
Random blood glucose level (mg / dl)	173.8 ±50.2	404.8 ± 47.5	344.7 ± 38.7	70.5 ± 8
Serum calcium level (mg / dl)	9.3 ± 0.85	9.5 ± 1.1	9.4 ± 0.9	9.3 ± 0.1
Serum Phosphorus lsvel (mg / dl)	5.1 ± 0.9	5.1 ± 0.9	5.1 ± 0.8	4.1 ± 0.2
Serum alkaline phosphatase activity (KAU / 100 ml)	7.1 ± 2.8	5.9 ± 2.8	7.4 ± 2.9	8.1 ± 2.7

Table (3): Percentage of Bone and Joint Manifestations in Male and Female Diabetic Children.

Bone & Joint Manifestations	Males	Females
Osteoporosis	32.79%	24.24%
Carpal tunnel syndrome	8.19%	21.21%
Trigger finger	8.19%	0%
Cheiroarthropathy	6.55%	0%
Dupuytren's contracture	1.63%	6.06%
Periarthritis of the shoulder	1.63%	3.03%
Bicipital tendinitis	1.63%	3.03%

Table (4): Percentage of Bone and Joint Manifestations in Various Age Groups of Diabetic Children.

Bone & Joint Manifestations	0-5 yr	6-10 yr	11-15 yr	> 15 yr
Osteoporosis	20%	21.21%	34.21%	37.5%
Carpal tunnel syndrome	0%	6.06%	21.05%	25%
Trigger finger	0%	0%	10.53%	12.5%
Cheiroarthropathy	0%	3.03%	5.26%	12.5%
Dupuytren's contracture	0%	0%	7.89%	0%
Periarthritis of the shoulder	0%	3.03%	0%	12.5%
Bicipital tendinitis	0%	0%	5.26%	0%

Table (5): Percentage of Bone and Joint Manifestations in Controlled and Uncontrolled Diabetic Cases.

Bone & Joint Manifestations	Controlled Cases	Uncontrolled Cases
Osteoporosis	33.33%	23.53%
Carpal tunnel syndrome	11.66%	14.70%
Trigger finger	5%	5.88%
Cheiroarthropathy	3.33%	5.88%
Dupuytren's contracture	1.66%	5.88%
Periarthritis of the shoulder	1.66%	2.94%
Bicipital tendinitis	0%	5.88%

Table (6): Percentage of Bone and Joint Manifestations in Diabetic Children Presenting with DKA and Those Without DKA

Bone & Joint Manifestations	with DKA	Without DKA
Osteoporosis	22.22%	31.58%
Carpal tunnel syndrome	16.66%	11.84%
Trigger finger	5.55%	5.26%
Cheiroarthropathy	5.55%	3.94%
Dupuytren's contracture	0%	3.94%
Periarthritis of the shoulder	5.55%	1.31%
Bicipital tendinitis	0%	2.63%

Table (7): Percentage of Bone and Joint Manifestations in Relation to Duration of of DM

Bone & Joint Manifestations	Recent discovery	< 1 yr	1-2 yr	2-4 yr	4-6 yr	> 6 yr
Osteoporosis	0%	11.76%	35%	42.86%	11.11%	27.27%
Carpal tunnel syndrome	0%	0%	5%	20%	33.33%	9.09%
Trigger finger	0%	0%	0%	5.71%	11.11%	18.18%
Cheiroarthropathy	0%	5.88%	0%	2.86%	0%	18.18%
Dupuytren's contracture	0%	0%	0%	5.71%	0%	9.09%
Periarthritis of the shoulder	0%	0%	0%	5.71%	0%	0%
Bicipital tendinitis	0%	0%	0%	0%	22.22%	0%

our study. Wiske et al. [8], stated that osteoporosis is a well recognized feature of IDDM. The pathogenesis of diabetic osteoporosis remain uncertain, however genetic, hormonal, metabolic, cellular, vascular and nutritional factors were suggested [9]. Males were more affected with osteoporosis than females (32.24% respectively). This agreed with the study of Santiago et al. [10], but did not agree with Rosenbloom et al. [11] in which females were more affected than males. Also, our study showed unstable correlation between the incidence of osteoporosis and duration of IDDM as more cases were detected with a diabetic duration < 4 years

while less cases were detected after 4 years diabetic duration. Wiske et al. [8], showed a negative correlation between bone mass and duration of diabetes, while Rosenbloom et. al.[11] found improved bone mass with longer duration of diabetes. Also our study failed to find correlation between osteoporosis and diabetic control. This agreed with Wiske et.al. [8]. However, Mc Nair et al. [12], found a strong correlation between bone mineral loss and fasting blood glucose level, glucosuria and insulin requirment as well as to declining C-peptide levels.

Carpal tunnel syndrome was present in 12.76% of diabetic patients. This agreed with Phalen [13]. In diabetes mellitus, the underlying neuropathy renders the median nerve more susceptible to compression [14]. Carpal tunnel syndrome was more common in females (21.21%) than in males (8.19%). Phalen [13], attributed this female predominance to hormonal changes. The incidence of carpal tunnel syndrome increased when the patient was older, the diabetes was not controlled and when there was DKA (Tables 4, 5 & 6).

In our study, trigger finger (flexor tenosynovitis) was found in 5.3% of diabetic children. Rosenbloom [11], stated that approximately a third of patients with flexor tenosynovitis had diabetes. He also stated that the development of this condition seems to be associated with proliferation of fibrous tissue in the tendon sheath. Trigger finger was more common in males (Table 3). While Band et al. [15], found that there was a marked female predominence. The incidence of trigger finger increased in uncontrolled diabetes, diabetic ketoacidosis and in cases of long diabetic duration (Tables 5, 6 & 7), these findings were supported by the of Mackenzie [16].

Our study reported cheiroarthropathy (limited joint mobility-LJM) in 4.25% of diabetic children. A higher incidence was reported by Starkman et al. [17], who detected LJM in 55% of children with IDDM. In our study LJM was more in males and this was against Pal et al. [18], who stated that no influence of sex on the incidence of these disorders. Also, we found that most cases affected with LJM were above the age of 10 years. Brice et al. [19], found that LJM was correlated with increasing age. Our study showed that the incidence of LJM was increased in uncontrolled diabetes and in cases of DKA (Tables 5& 6). Pal et al. [18] found that LJM was not related to the degree of control of diabetes and that the duration of diabetes had a greater influence in the development of LJM. However, Rosenbloom [2], suggested a greater influence of patient's age than diabetic duration on the appearence of LJM and this agreed with our study in which the incidence of LJM was 5.98% with diabetes duration < 1 year while no cases of LJM were detected in diabetic patients with a duration > 4 years diabetes (Table 7).

Our study showed association between

diabetes mellitus and dupuytren's contracture where we detected it in 3.1% of diabetic children. Noble et al. [20] found strong association between diabetes and dupuytren's contracture and it was unknown whether metabolic derangement or genetic pattern creates this association. Also our study showed that dupuytren's contracture was more in females than in males (6.06%& 1.63% respectively). This agreed with Phalen [13]. Also our study showed that dupuytren's contracture occurred in older children 11-13 years. Larkin and Frier [21] found that dupuytren's contracture was related to increasing age. Also our study showed that dupuytren's contracture was more in uncontrolled diabetes and in cases of diabetic duration more than 6 years (Table 7). This was against Pastan and Cohen [14] who stated that there was no correlation existed between duration and severity of diabetes and dupuytren's contracture.

Periarthritis of the shoulder was present in 2.21% of diabetic children. This agreed with Pal et al [18], who found it in 19% of diabetic patients. The incidence in our study was lower than the previous report and this may be related to age factor as we found that periarthritis of the shoulder was common in older children (< 15 years old) as shown in table (4).

Wright and Haq [22], found that periarthritis of the shoulder occurred in the 5th. decad or later. In our study females were more affected with periarthritis of the shoulder than males (3.03% & 1.63% respectively). The same results were obtained by Wright and Haq [22]. We also observed that periarthritis of the shoulder was dependent on the severity rather than the duration of diabetes. Tables (5&6) showed that periarthritis of the shoulder was more common in uncontrolled diabetes and in DKA cases.

Lastly osteolysis, neuroarthropathy with charcot joint and diffuse idiopathic skeletal hyperostosis were not detected in our patients. Rosenbloom [2] did not detect any of these cases in his study and he stated that these disorders were rarely seen before age of 21 years old.

We conclude that bone and joint manifestations are not uncommon in diabetic children. So we recommend serial evaluation of diabetic children for early detection and control of bone and joint complications of insulin dependent diabetes mellitus.

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