Biochemical Survey of Copper, Zinc, Iron and Lead Status in the Serum of VVF Patients Attending Ebonyi State University Teaching Hospital, Abakaliki

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Abstract

In this study, the concentration of the trace elements: iron (Fe), zinc (Zn), copper (Cu) and lead (Pb) in the serum of vesico-vaginal patients (VVF) and normal individuals were determined spectrophoto-metrically. The study was carried out on 102 individuals consisting of 66 patients and 36 normal individuals as controls. The mean concentrations of Fe were 63.95± 42.30mg/l for control and 38.89 ± 16.85mg/l for patients. The Zn levels for the patients were 9. 41±1.66mg/l and 22.02 ± 9.34mg/l for the control. The mean values for Cu in patients and controls were 1.76 ± 0.58mg/l and 1.65 ± 0.75mg/l respectively while the mean values recorded for Pb were 0.39 ± 0.64mg/l for patients and 0.86 ± 0.67mg/l for control. Statistical analysis showed that there were significant differences (P<0.00) between the levels of Fe and Zn in the patients and controls but the levels of Cu and Pb showed no significant differences (P<1.00). Also there were significant difference in the height of controls and patients. This study indicates that height; Fe and Zn have significant effects in the etiology of vesico vaginal patients (VVF).

Keywords: Trace elements, Vesico vaginal patients (VVF)

Introduction

Vesico vaginal fistula (VVF) is an extraurethral incontinence, which can be caused by an abnormal communication between the urinary tract (bladder, urethra or ureter) and the vagina. It is one of the most degrading morbidities resulting from pregnancy and childbirth. Incontinence is often continuous, but can vary depending upon certain circumstances or patient position. Patients usually have insensible incontinence, that is loss of urine without increase in abdominal pressure or urge. Maternal morbidity as a result of VVF or RVF (Recto vaginal fistula) is particularly high in northern Nigeria. Out of an estimated 150,000 cases of VVF in Nigeria, 70% occur in the North (Lawson, 1988; Elkins, 1994).

In developing countries birth trauma accounts for the majority of fistula (Arrowsmithe *et al.,* 1996). Prolonged labour induces tissue necrosis of the bladder base and urethra which results in substantial tissue loss. Regardless of the etiology, fistula can make life unbearable for the patient. The most common cause of vesico vaginal fistula is abdominal or vaginal hysterectomy and approximately 75% of genitourinary fistula occurs in this way (Symmond, 1984; Tancer, 1992). Fistula occurring after hysterectomy is thought to be due to tissue necrosis caused by inadvertent suture, incorporation of vaginal tissue from the cuff closure into an unrecognized bladder wall.

Other causes of fistula include malignancy (Tancer, 1992) radiation (Cushing, 1993), inflammatory bowel disease and tuberculosis (Ba-Thike *et al.,* 1992). Rarely, foreign bodies such as pessaries, diaphragms, and intrauterine devices also may lead to fistula formations latrogenic CO_2 laser therapy for cervical diseases has resulted in bladder fistula (Tancer, 1992). Autoimmune diseases such as Bachet's disease have also been recently implicated in vesico vaginal fistula due to extensive vesculities related bladder wall necrosis (Tancer, 1992).

Trace elements such as zinc, copper, iron, cobalt, etc are needed by the body in minute amounts and they play leading roles in the production of enzymes, hormones and other substances that help to regulate growth, development and the functioning of the immune and reproductive systems (Edeogu *et al.,* 2007). According to the United Nation Independence Children Education Fund, UNICEF 1998, adequate intake is crucial during childhood and other periods of rapid growth, pregnancy and breastfeeding

The lack of some of these trace elements may promote vesico virginal fistula, since these nutrients have effect on growth, immune function, pregnancy, reproductive system, bone development and wound healing. Individual lacking zinc may develop osteoporosis or slow bone growth (Golub *et al.,* 1996) which can lead to birth trauma and possibly vesico vaginal fistula. Also zinc helps to boost immunity (Cakman *et al.,* 1997) which can fight some diseases like bilharziasis which may cause vesico vaginal fistula, though on rarer cases.

Evaluating the levels of these trace elements in the serum of VVF patients is an important aspect of public health management. However, available data on the trace elements status of the VVF patients in Ebonyi State is grossly inadequate as most researches about VVF are conducted in the Northern part of Nigeria. The dearth of information has negatively affected the patients in this part of the country.

The objective of this study therefore is to investigate the levels of Zn, Cu, Pb and Fe in the

patients attending Ebonyi State University Teaching Hospital (EBSUTH), Abakaliki as part of efforts in the effective management of VVF in the state.

Materials and Methods

Location of the study area: The study area is located in Ebonyi State, in the central part of the eastern region of Nigeria. Specifically, the project site is Abakaliki. The entire study area lies within the Cross River Basin and are in the humid zone with a climate typical of the tropical zone. That is, wet-hot and rain. Cross River-system, Ebonyi-River system and Azu-River system are the major inland water bodies. The hydrochemical and hydrobiological properties of the river systems are of technical interest, considering the abundant sodium chloride content of Azu-River system and the guinea worm (*Dracunculus medinensis*) infestation in the study area.

Sample collection: Blood samples were collected from hundred and two (102) individuals. Sixty six (66) samples were got from vesico-vaginal fistula patients while 36 samples from normal individuals, served as control. A tourniquate was tied on each patient hand to review her vein with the use of a 5ml syringe the blood was collected and was emptied inside a vacutainer, the plasma was separated from the serum and stored in freezer until the analysis was done colorimetrically.

Equipment: The equipment used was Buck Scientific Atomic Absorption/Emission Spectrophotometer 205 Model, Centrifuge: Mse Minor 35, Oven by B and TA Searle Company and Muffle furnace: IMF 4 Carbolite Sheffield England was used.

Preparation of standard solutions: The primary solution was prepared using the appropriate salt. The salts used in the preparation of the standard or primary solution are shown in Table 1 and the concentration of the trace element in the sample being analyzed was read off from the calibration curve of the standard.

Table 1: Salts used in the preparation of standard solution (Stewarte *et al.,* 1974)

Trace element	Salt
Zinc (Zn)	$ZnSO_4.7H_2O$
Copper (Cu)	$CuSO_4.5H_2O$
Lead (Pb)	$Pb(NO_3)_2$
Iron (Fe)	$FeSO_4.6H_2O$

Sample Preparation: The volume of each sample in the bottle was measured with a micro-cylinder and recorded. After which it was put into a beaker and kept on a hot plate where it was evaporated to dryness. The dry deposit was taken into a furnance and ashed at temperature of 400-500^{O}C for about an hour. Thereafter the Sample deposit was left in an ash form. It was allowed to cool, followed by the addition of an aqua-regia (concentration of HCl and HNO_3 in the ration of 3:1). The mixture was taken back to hot plate for heating so as to digest the mixture until the reaction mixture was completely dried. After digestion, 20ml of de-ionized water was added to each of the mixture and stirred, after stirring, it was filtered.

Sample analysis: The filterate was then analyzed for the trace elements using Atomic Absorption spectrophotometer, at wavelength of 324.8nm, 213.86nm, 248.33nm, and 238.30nm for Cu, Zn, Fe and Pb respectively. The absorbance of the metal was read from the standard curve. Then the value was converted to mg/l.

Results

The iron levels of the samples were in the range of 29.05mg/l to 71.07mg/l and mean value of 38.89$\pm$16.85mg/l for the patients. In the control, the iron range is 21.96mg/l to 122.43mg/l and mean value of 63.95$\pm$42.30mg/l. this indicates that iron is one of the abundant elements in the serum. The values obtained in both the patients and the control exceeded the normal serum level of 21.0µmol/l (Zilva and Pannall, 1987). This confirms an early report that the dietary intake of iron by people in the developing countries is generally high (Harvey *et al* 2000).

The levels of Zn in the patients ranged from 6.87 to 11.16mg/l with a mean value of 9.41 $\pm$ 1.66mg/l while in control, the Zn level ranged from 11.41 to 35.90mg/l with a mean value of 22.02 $\pm$ 9.34mg/l. The zinc levels in control is significantly higher (P<0.00) than in the patients. The levels of copper ranged from 0.90 to 2.88mg/l with a mean value of 1.65 $\pm$ 0.75mg/l in control while in VVF patients the values ranged from 1.14 to 2.66mg/l with a mean value of 1.76 $\pm$ 0.58mg/l. Statistical analysis revealed that the level of copper in patients is not significantly different from the control.

The Pb level in patients ranged from 0.01 to 1.72mg/l with a mean value of 0.86 $\pm$ 0.67mg/l while the controls recorded a range of 0.00 to 1.68mg/l and a mean value of 0.39 $\pm$ 0.64mg/l. There is no significant difference between the Pb levels in patient and control (P<1.00).

The height of the patients ranged from 1.45m to 1.49m with a mean value of 1.49 $\pm$ 0.03m while that of the controls is in the range of 1.63m to 1.68m and a mean value of 1.65 $\pm$ 0.02m (see tables 2 and 3). There is significant difference between the height of the patients and control (P<0.05).

Discussion

The results indicate that iron had the highest concentration in mg/l for both the patients and controls. The mean value of iron recorded in the serum of patients was significantly lower than the control (P<0.05). However, the mean values for the patients and controls were higher than the values obtained in the previous studies in the area by Edeogu *et al,* (2007), Ifemeji (2004) and Nweke *et al.,* (2004). The mean value of Zn in the serum of the VVF patients is 9.41 $\pm$ 1.66mg/l, while that of the control is 22.20mg/l. The value obtained in the patients is low when compared to 21.20 $\pm$ 0.13mg/l got from the area by Edeogu *et al.,* (2007).

Table 2: Age distribution, height and mean value of trace elements in mg/l of VVF patients

Age distribution (yr)	Frequency	Mean height	Trace elements in mg/l			
		(m)	Fe	Zn	Cu	Pb
15 – 20	16	1.47	35.11	8.64	1.95	1.29
21 – 25	15	1.46	29.05	8.57	1.14	0.72
26 – 30	18	1.51	40.68	10.74	2.07	1.24
31 – 35	8	1.54	34.34	11.16	1.09	0.02
36 – 40	4	1.45	23.12	6.87	1.66	0.01
41 – above	5	1.49	71.07	10.49	2.66	1.72
Mean value		1.49 ± 0.03	38.89 ± 16.85	9.41 ± 1.66	1.76± 0.58	0.86 ± 0.67

Table 3: Age distribution, height and mean value of trace elements in mg/l of non-VVF patients

Age distribution (yr)	Frequency	Mean height	Trace elements in mg/l			
		(m)	Fe	Zn	Cu	Pb
15 – 25	2	1.65	21.96	11.41	1.59	0.19
21 – 25	7	1.63	36.49	21.74	0.92	0.08
26 – 30	5	1.67	39.31	21.60	2.09	0.04
31 – 35	1	1.68	111.51	12.77	2.88	0.00
36 – 40	10	1.62	52.00	35.90	0.90	0.35
41 – above	3	1.63	122.43	28.71	1.50	1.68
Mean value		1.65 ± 0.02	63.95 ± 42.30	22.02 ± 9.34	1.65 ± 0.75	0.39 ± 0.64

However, the mean value of the control is within the range obtained in the previous studies by Nweke *et al.,* (2004) and Edeogu *et al.,* (2007).

The results revealed significant difference (P<0.00) in serum Zn levels of the patients and controls. Thus indicating that Zn plays a vital role in the development of VVF since its level is lower in the patients than controls.

The mean value of Cu in the patient is 1.76 ± 0.58mg/l while the control had a mean value of 1.65 ± 0.75mg/l. The results indicate that the levels of Cu in VVF patients and controls were not significantly different and that values obtained for both patients and controls were within the internationally acceptable recommended daily allowance of copper for adults 1.50 – 3.0mg/day (Guthrie and Picciano, 1995). This implies that Cu does not have a significant role in the etiology of VVF. The results of this study show no significant difference in the levels of lead in patients and controls. Thus, Pb although has inhibitory effects on the synthesis of haemoglobin, it has no effect in the pathology of VVF. The significant difference in the height of patients and controls suggests that height which is the consequences of nutritional status of the individual during the period of active growth and development plays a vital role in the etiology of VVF.

In conclusion, VVF can be prevented by integration of maternal and child health education in the schools, provision of free antenatal care and delivery services, creation of employment to alleviate poverty in the Country. These measures would ensure adequate nutritional diets for growth and proper bone development that will reduce incidence of prolonged and obstructed labours that give rise to VVF in our immediate environment.

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