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Face Masks- the most Convenient and Cost-effective Measure Against SARS-CoV-2 Infections

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The recent threat of Corona virus (SARS-CoV-2) infection and disease (COVID-19) pandemic started since December, 2019 originating in Wuhan City of Hubei province, China.[1] We have witnessed very diverse situations regarding all about the virus and its infection or disease. The notorious virus did not follow any common rule of a virus-all relating to structure, immunobiology, pathogenesis, clinical presentations and treatment or management. Perhaps, this is the principal reason of endless threat of the virus around the globe. Therefore, all concerned healthcare workers are trying their best to find out the effective measures to control the virus. Vaccination, development of more sensitive and specific test methods for early diagnosis of the virus, and effective antiviral agents are few of the significant measures that are on the priority lists of the medical scientists. However, no single measure of the issue was found to support as the most effective means for prevention and control of SARS-CoV-2.[2,3]

With the same perspective, World Health Organization (WHO) advises to cover mouth and nose with mask as part of a comprehensive package of prevention and control measures to limit the SARS-CoV-2, the virus that causes COVID-19.[3] Now, how much a mask helps in the prevention and control of SARS-CoV-2 infection is a big question. WHO says, "a mask alone, even when it is used correctly, is insufficient to provide adequate protection or source control". WHO also includes other infection prevention and control (IPC) measures like hand hygiene, physical distancing of at least one metre, avoiding of touching one's face, respiratory etiquettes to cover sneezes and coughs, adequate ventilation in indoor settings, testing, contact tracing, quarantine and isolation.[2,3] According to Centers for Disease Control (CDC), masks work best when everyone wears one.[4] Because, when someone wears a mask, it can protect (i) him/herself from being infected as well as (ii) others around him/her from being infected from the person wears it, if he/she is carrying the virus having COVID-19 disease or carrying the virus without having any symptom (asymptomatic carrier) by simply preventing the transmission of the virus. CDC also recommends that one should wear a mask even when he/she is sick.[4] This is because several studies have found that people with SARS-CoV-2 who never develop symptoms (asymptomatic) or those who are not yet showing symptoms (presymptomatic) can still spread the virus to other individuals.[5-8]

Why masks are important in prevention and control of SARS-CoV-2 infections? It becomes clear considering routes of transmission and pathogenesis of the virus, it becomes clear that SARS-CoV-2 is transmitted from person-to-person by many different routes.[9,10] Among the different modes of transmission, major routes are: (i) inhalation of the virus contained in droplets directly from coughs and sneezes of infected persons through nostrils (direct infection-droplet infection) or airborne, i.e., indirectly from the air containing expelled droplets (indirect infection-droplet nuclei) and (ii) intake of the virus through mouth to reach upper respiratory tract for exam-

ple pharynx, is significant for infection.[6] Controlling respiratory infection at source using a face mask is found to be a helpful strategy. In this perspective, wearing the mask appropriately is very important- so that the virus containing droplets cannot enter through any weak areas of mask fitting over the mouth. Usually when the mask is worn casually over nasal bridge, there might be some areas of loose-fitting gaps to allow dusts and droplets/ droplet nuclei to enter nose and mouth. Most often some persons are found to keep the mask below the nostrils- over the chick or even ridiculously under the chick (unpublished observations).These are not recommended and obviously, these sorts of casual wearing of masks cannot protect from the virus.[11]

Now, who should wear a mask? CDC recommends that everyone 2 years old and above should wear a mask in public places, where he/she is around the people, who are not living in his/her household.[4] In the same document, CDC also recommends that mask should be worn when caring for someone who is sick (whether at home or at a healthcare setting) and a mask should also be worn if someone is sick with COVID-19 or suspects that he/she is infected with the virus when he/she needs to be around other people, even when he/she is at home.

CDC also recommends who should not wear a mask.[4,12] They listed 4 categories of people not to wear a mask- for example: (i) children younger than 2 years of old, (ii) anyone who has trouble in breathing, (iii) anyone who is unconscious, incapacitated, or otherwise unable to remove the mask without assistance, and (iv) wearing mask could be difficult for some people with sensory, cognitive or behavioural issues. If some people are unable to wear a mask properly or cannot tolerate a mask, masks should not be worn by them- rather adaptations and alternatives should be considered for these people. In all situations when wearing a mask may not be possible, everyone should make sure to maintain a physical distance of at least one metre from others. Situations could be during dining in a restaurant, or swimming at a beach or pool, or during high intensity working leading to difficulty in breathing.[4]

There are three different categories of masks for use by specific groups of people according to their nature of the jobs. General public require to wear an ordinary cotton fabric woven mask when he/she is in a crowd or in areas of community transmission. A surgical mask is required for routine healthcare duties by the healthcare workers. A special mask, for example N95 respirator, along with full-gear personal protective equipment (PPE) is required for people working with the identified or suspected COVID-19 patients- even for taking care of such patients in the home.[12] Medical masks and N95 respirators should be conserved for healthcare workers only. Some masks work better than others to stop SARS-CoV-2 outside healthcare settings. CDC recommends masks for general use which fit properly (snugly around the nose and chin with no large gaps around sides of the face), made with breathable fabric like cotton or with tightly woven fabric like fabrics that do not let light pass when held up to a light source and masks with two or three layers and inner filter pockets.[4] On the other hand, the CDC does not recommend masks that (i) do not fit properly keeping large gaps, being too loose or allow passing too light, (ii) made from materials that are hard to breathe through like plastic or leather, or made from loosely woven fabric or knitted letting light to pass through, (iii) masks with one layer, (iv) masks with inhalation valves or vents and (v) wearing a scarf or ski as a mask.[4]

Finally, considering all available information, it appears that proper use of recommended mask along with keeping social distance and practicing hand hygienecould be the best possible preventive measure for all groups of individuals. Moreover, face masks are relatively cheap, easily available and easy to wear. This is more essential in countries like Bangladesh, where social and physical distancing approach is less feasible. Therefore, universal masking of people strategy can be achievable by which repeated wave of COVID-19 can be prevented.

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Study on Haematological parameters in Kala-azar Patients of Bangladesh

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ABSTRACT

Introduction: *Kala-azar or Visceral Leishmaniasis (VL) is a chronic infectious disease caused by the parasite Leishmania donovani. It is an endemic disease in Bangladesh and characterized by various haematological parameter changes in patients. The present study aimed to evaluate the changes of haematological parameters in Kala-azar patients of Bangladesh and compare with control group (healthy person).* ***Methods:*** *This cross-sectional study was conducted in 'Surjokanto Kala-azar Research Centre' under supervision of Mymensingh Medical College Hospital in Mymensingh during the period of July 2015 to June 2016, enrolling 56 Kala-azar patients and 30 healthy persons. All findings were recorded in a predesigned proforma.* ***Results:*** *The haematological assessment revealed that Haemoglobin level, Erythrocyte Sedimentation Rate, total White Blood Cell count and Platelets counts were significantly ($p<0.001$) changed in Kala-azar patients.* ***Conclusion:*** *This study concluded that the changes of haematological parameters are helpful for the diagnosis and therapeutic purpose of Kala-azar patients. We suggest that routine haematological investigation should be done in suspected Kala-azar patients.*

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INTRODUCTION

Leishmaniasis is an infectious disease which is caused by an intracellular parasite of the genus Leishmania and transmitted during blood-feeding by the infected female sand flies.[1]The word "Kala-azar" has been derived from two Indian words "Kala" and "Azar" meaning "Black sickness"- an illness in which the colour of the skin turns darker. On the basis of clinical syndromes, Leishmaniasis is of four types: A. Cutaneous Leishmaniasis; B. Muco-cutaneous Leishmaniasis; C. Visceral Leishmaniasis and D. Post Kala-azar Dermal Leishmaniasis (PKDL).[2] Visceral Leishmaniasis (VL) is also known as Kala-azar or black fever or Dumdum fever. This disease is vector- borne chronic febrile illness which is mainly caused by Leishmania donovani in our region (South Asia).[3] Kala-azar is a parasitic disease of the reticuloendothelial system (RES) characterized by fever, anaemia, splenomegaly, hepatos-

plenomegaly, leukopenia, progressive weakness and emaciation, which can result in death if left untreated. Children are at greater risk than adults in endemic areas.[4] Specifically six countries of the world are at greater risk of Kala-azar. Three of them are in South Asia, namely: Bangladesh, India and Nepal and the other three countries are Sudan, Ethiopia and Brazil. Statistics shows that more than 90% of cases occur in these countries. Out of 64 districts of Bangladesh, 45 are endemic for VL and 20 million people, around 18% of the total population, are considered to be at risk for VL. Migration, poor housing and sanitary conditions, malnutrition and HIV co-infection are the main factors those increase the frequency of Kala-azar.[5,6] An estimated 350 million populations are at risk and 10 million people are affected from this disease worldwide.[7]

Changes in some haematological parameters indicate the occurrence of Kala-azar. Some parameters are so significant that quickly represent the incidence of the disease. Alterations in these parameters occur due to pathophysiological changes of the patient. Haematological parameters such as the total White Blood Cell count, haemoglobin level (Hbgm/dl), erythrocytic sedimentation rate (ESR), platelet count and packed cell volume (PCV) are significant for Kala-azar patients.[8] In Kala-azar patients haematological findings include progressive leucopenia, anaemia, thrombocytopenia and increased ESR. Some biochemical and immunological parameters such as serum bilirubin, serum creatinine, alkaline phosphatase(ALP), alanine aminotransferase (ALT), aspartate aminotransferase (AST), serum total protein, albumin, globulin, albumin-globulin ratio and IgG are also important.[9,10]

The aims of this study were to determine the haematological parameters of Kala-azar patients and compare them with the healthy persons to know which parameters are significant to the disease.

METHODS

This cross-sectional type of descriptive study was conducted in Mymensingh district due to higher prevalence of Kala-azar in this region. Patients were selected from 'Surjokanto Kala-azar Research Center' (SKRC) which is under supervision of Mymensingh Medical College Hospital, Mymensingh. A total number of 56 Kala-azar patients (35 males and 21 females) aged up to 60 years were selected for this study. All Kala-azar patients were free from comorbidity such as malaria, enteric fever, chronic liver disease, thalassemia, lymphoma, leukemia, diabetes mellitus and hypertension etc. Thirty (30) healthy persons (18 males and 12 females) were also included as control group from same socio-demographic background. The patients were diagnosed by clinically and serum rK39 immunochromatographic test. To conduct this study, ethical permission was taken from the authority of SKRC and informed written consent was taken from the study subjects. Data were collected by using structured questionnaire as well as from interviews and observations. After confirmed diagnosis, patients were investigated for haematological profile, especially Hb level, ESR, total WBC count, platelet count. Patient's age, sex, education, occupation, living status, family history of the disease, knowledge about Kala-azar and sand fly vector were also recorded.

Specimen collection: Every subject spontaneously gave two milliliters of venous blood that were collected by disposable syringe. Then the blood specimens were immediately transferred to the labeled test tube containing anticoagulant e.g. Ethylenediaminetetraacitic acid (EDTA).

Haematological study: Haemoglobin level, ESR, total WBC count, platelet count were measured according to different recommended methods.

Statistical analysis: The data obtained from this study was analyzed with SPSS program (version-20). Results were expressed as Mean±Standard error of the Mean (SEM). Statistical significance was assessed by independent student's '*t*' test. A *p* value ‹0.05 was considered statistically significant.

RESULTS

Among 56 Kala-azar patients, majorities 25, (44.60%) were in the 18-40 years age group, whereas 21 (37.50%)were more than 40 years and 10 (17.90%) were below 18 years (Table I).

Table I: Age distribution of the study patients (n-56)

Age groups (in year)	No. of patients	Percentage (%)
<18	10	17.90
18-40	25	44.60
40-60	21	37.50

Within the control group majority 17 (56.66%) in the 18-40 years, whereas 6 (20.00%) were more than 40 years and 7 (23.34%) were below 18 years (Table II).

Table II: Image distribution of control group (n-30)

Age groups (in year)	No. of healthy Person	Percentage (%)
<18	7	23.34
18-40	17	56.66
40-60	6	20.00

Out of 56 Kala-azar patients, majority were male 35 (62.5%) and female 21 (37.5%). Among the control group male were 18 (60%) and female were 12 (40%). The male and female ratio was 1.67:1 in patient group and 1.5:1 in control group (Figure 1).

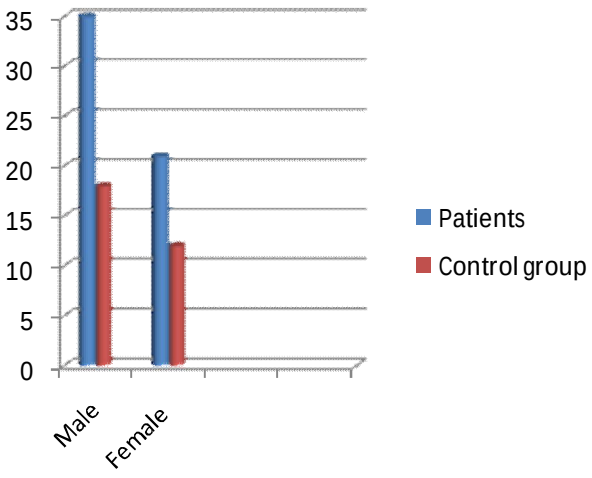

Figure 1: Sex distribution in Kala-azar patients and control group

In this study, all the patients 36 (100%) patients suffered with fever, 43 (76.8%) showed weight loss. Darkening of the skin and bleeding occurred in 34 (60.7%) and 21 (37.5%) of patients, respectively. Regarding clinical signs, anemia 23 (50%) and splenomegaly 42 (75%) were more frequent in a large number of patients. But hepatomegaly, hepatosplenomegaly and lymphadenopathy were less common (Table III).

Table III: Symptoms and signs in Kala-azar patients (n-56)

Traits	No. of patients	Percentage (%)
Symptoms		
Fever	56	100
Weight loss	43	76.8
Darkening of skin	34	60.7
Bleeding	21	37.5
Signs		
Anemia	23	50
Splenomegaly	42	75
Hepatomegaly	11	19.6
Hepatosplenomegaly	7	12.5
Lymphadenopathy	5	8.9

*Multiple responses

ESR (81.34 ± 5.29 mm/hour) level of Kala-azar patients were high and Hb level (10.56 ± 0.36 g/dL) were decreased significantly compared to controls. On the other hand, total count of WBC and platelet were decreased to its lower normal limit in all Kala-azar patients (Table IV).

Table IV: Comparison of the haematological parameters among patients and control

Parameters (unit)	Kala-azar patients	Controls	*p*-value	Post test result
ESR (mm/hr)	81.34 ± 5.29	30.63 ± 2.8	<0.0001	*
Hb (g/dL)	10.56 ± 0.36	14.62 ± 0.21	<0.0001	*
Platelets (x10^9/L)	150.26 ± 11.5	313.5 ± 8.81	<0.0001	*
WBC (per µL)	4312.4 ± 263.6	7140 ± 281.5	<0.0001	*

* Significant

DISCUSSION

The present study was conducted to identify potential haematological changes in Kala-azar (Visceral Leishmaniasis,VL) patients in comparison with healthy group. These haematological changes are valuable for the diagnosis and treatment of the patients. The total subjects were of the same geographic region, minimizing differences in genetic background of the human population or diversity in parasite behaviour as well as reducing differences in clinical care observed in distinct regions.

In this study, prevalence of Kala-azar in male and female was 62.5% and 37.5% respectively. Boggiatto et al.[11] found that the number and percentage of male patients (40, 56.3%) were higher than female patients (31, 43.7%). In another study, conducted by Singh et al.[7]established that infection of VL had higher prevalence in males than females in India. The study of Bhowmick[12] revealed that the prevalence of Kala-azar was higher in males (51.22%) than females (36.96%). These findings were almost similar to our findings. Those were may be due to occupational variation.

The most marked symptoms in Kala-azar patients were fever and weight loss, which may be due to infection and anorexia. Bleeding and darkening of the skin were also present possibly caused by thrombocytopenia. Among the signs, anaemia was more prevalent in the patients. The presence of anaemia in Kala-azar patients would suggest intravascular volume contraction.[13] Splenomegaly (75%) was a vital feature of the clinical presentation in our study. In one study conducted by Islam et al.,[14] Splenomegaly was reported to be present in 100% of patients, but it may be absent in immunocompromised patients, such as those who are HIV positive, renal transplant recipients, those with haematological malignancies and those on long-term steroids therapy. Several studies[15,16] revealed that splenomegaly may be absent in acute cases, or in the early stages of the disease. Besides, hepatomegaly, hepatosplenomegaly and lymphadenopathy were less frequent in those patients.

Haemoglobin concentration in patients suffering from VL was lower than in healthy controls. This finding is consistent with the findings reported by Rahim et al.[17]and Collin et al.[18] Our study revealed thrombocytopenia in 32 out of 56 patients with mean platelet count of 150.26x10^9/L, whereas Dhingra et al.[19] reported thrombocytopenia in 11 out of 18 cases with a mean platelet count of 84 x 10^9/L. Raiet al.[20] found raised ESR in 88% cases but in this study, raised ESR in 81.34% cases. Early and striking manifestation of VL is leucopenia. About 75% patients with VL have been shown to have leucopenia in various studies.[21, 22] This study showed leucopenia in 54% patients and mean WBC count was 4312.4±263.6/µL which was possibly due to hypersplenism.

CONCLUSION

This study revealed haematological changes are linked to the diagnosis of Kala-azar. It also suggests to include fever, weight loss, darkening of skin, anaemia and splenomegaly as key signs and symptoms for diagnosis of Kala-azar, particularly in Bangladesh. Further studies are essential to investigate other haematological and biochemical changes related to Kala-azar in two more phases: during treatment and after treatment.

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ORIGINAL ARTICLE
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Study on Serum level of Copper and Calcium in Type 2 Diabetic subjects

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ABSTRACT

Introduction*: Diabetes mellitus (DM) is a group of metabolic disorders characterized by high blood sugar level over a prolonged period of time which affects carbohydrate, lipid and protein metabolism. It causes death due to multiorgan failure. Calcium (Ca) helps in insulin secretion as it is a calcium dependent process. Excess copper (Cu) is associated with DM, increased free radical production leading to oxidative damage to various tissue and organs. This study was designed to evaluate the serum Cu and Ca status in type2 diabetes mellitus patients.* ***Methods****: This cross-sectional study was done among 60 diagnosed type 2 diabetic patients and 60 healthy people in the Department of Biochemistry, Mymensingh Medical College, Mymensingh over a period of one year from January 2015 to December 2015. Estimation of serum Cu and Ca level were done by colorimetric method by using test kits. All statistical analyses were performed by SPSS windows package, version 20. Significance of the difference between two groups was evaluated by using student's unpaired 't' test.* ***Results:*** *Study revealed that calcium levels were significantly decreased and copper levels were significantly increased in type2 diabetic patients.* ***Conclusion:*** *It can be concluded that the prevalence of decreased level of calcium and increased level of copper occurs in type 2 diabetic patients. So, in type 2 diabetic patients, calcium supplementation may be beneficial.*

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INTRODUCTION

Diabetes mellitus (DM) is probably one of the oldest diseases known to human. It was first reported in Egyptian manuscript about 3000 years ago.[1] It is aheterogeneous metabolic disorder characterized by chronic hyperglycemia resulting from defects in insulin secretion, resistance to insulin action or both. The effects of DM include long-term damage, dysfunction and failure of various organs. Diabetes can lead to kidney disease, heart disease, nerve damage and loss of vision.[2] It is one of the greatest medical problems with the worldwide explosion in its prevalence.[3] According to recent estimates the worldwide prevalence of DM is 4.2% and that indicates 150 million peoples are affected, it will

increase to 439 million by the year 2030.[4,5]

Micronutrients play crucial roles in human nutrition, regulation of metabolism (Carbohydrate, lipid and protein), heartbeat, cellular pH and bone density. People with type 2 DM has more tendency to increase morbidity and mortality due to insidious onset and late recognition, especially in poor developing countries like Africa.[6]

Copper (Cu) is an essential trace element, capable of fluctuating between the oxidized Cu^{2+} and the reduced Cu^{+} state, being co-factor for many enzymes. This divalent cation is involved in super oxide dismutase (SOD) activity. Excess copper (Cu) aggravates the hyperglycemia which causes glycation of various proteins and also displaces copper from copper binding site of protein and thus further aggravates the hypercuperemia, which lead to more oxidative damage to various tissue and organs. So, Cu through its oxidative stress, impairs the functions of islets of pancreas, leading to type 2 DM.[7]

Calcium is essential for insulin-mediated intracellular processes in insulin-responsive tissues, such as skeletal muscle and adipose tissue. It has beneficial effect on insulin action directly, by stimulating the expression of insulin receptor and thereby enhancing insulin responsiveness for glucose transport.[8,9]

Decreased calcium level in primary insulin target tissues may contribute to peripheral insulin resistance via impaired insulin signal transduction leading to decreased glucose transporter-4 activity.[10] So, Ca improves insulin sensitivity and promotes β-cell survival by directly modulating the generation and effects of cytokines.[11]

METHODS

This cross-sectional study was carried out in the Department of Biochemistry, Mymensingh Medical College, Mymensingh and the subjects were collected from the Outpatient Department (OPD) of Endocrinology, Mymensingh Medical College Hospital, Mymensingh during the period of January 2015 to December 2015. A total number of 120 subjects were studied. There were 60 cases and 60 controls. In both case and control groups male and female subjects were equally distributed (1:1). Persons having no acute complications, serious co-morbid diseases and history of renal failure were selected in both case and control groups. All study subjects were informed about the procedure and their informed written consent were taken before collection of sample. With all aseptic precautions, 6 ml of venous blood was collected from the study subjects after overnight fasting by a disposable syringe from antecubital veins. The blood was transferred to a dry screw capped sterile test tube immediately after removal of needle from the syringe with a gentle push to avoid haemolysis. Test tube was kept in vertical position until clot formation and then centrifuged at 3000 rpm for 5 minutes. Clear serum was taken out by micropipette in a plain plastic microcentrifuge tube. Estimation of serum copper and calcium were done as soon as possible by colorimetric method using test kits. In case of any delay, the sample was stored at -20 ^{0}C. Serum glucose was estimated using enzymatic method by GOD-PAP.

All statistical analysis was done by using Statistical Package for Social Science (SPSS), version-20. Results were expressed as Mean±Standard Deviation (SD). Statistical significance of reference between two groups was evaluated by using student's unpaired t test and 95% confidence limit was taken as level of significance.

RESULTS

In group 1 (case) mean blood glucose level at fasting was 9.83±1.33 mmol/L and two hours after oral glucose intake was 15.62±3.76 mmol/L, while in group 2 (control) mean blood glucose level at fasting was 4.51±0.48 mmol/L and two hours after oral glucose intake was 6.40±0.50 mmol/L respectively (Table I). In diabetic subjects, fasting and two hours after oral glucose intake, serum glucose levels were significantly higher than that of control group ($p<0.001$).

Table I: Blood glucose level in the study subject

Variables	Group 1 (Case) (Mean±SD)	Group 2 (Cotrol) (Mean±SD)	*t* value	*p* value
Fasting blood glucose (mmol/L)	9.83±1.33	4.51±0.48	29.049	$p<0.001^*$
2 hours after oral glucose intake (mmol/L)	15.62±3.76	6.40±0.50	18.842	$p<0.001^*$

Unpaired student's 't' test, *Significant

The mean serum copper levels in group 1 and group 2 were 111.37±45.19 µg/dl and 89.46±29.71 µg/dl respectively (Table II). There was significantly increased ($p<0.002$) serum copper level in group 1 compared to that in group 2.

The mean serum calcium level in group 1 and group 2 were 9.02±1.80 mg/dl and 11.33±3.03 mg/dl respectively (Table II). There was significantly decreased ($p<0.001$) of calcium in group 1 compared to that in group 2.

Table II: Serum copper and calcium level in the study subjects

Variables	Group 1 (Case) (Mean±SD)	Group 2 (Control) (Mean±SD)	*t* value	*p* value
Copper (µg/dl)	111.37±45.19	89.46±29.71	3.138	$p<0.002^*$
Calcium (mg/dl)	9.02±1.80	11.33±3.03	5.072	$p<0.001^*$

Unpaired student's *'t'* test, *Significant

DISCUSSION

It is well established that both the deficiency and possible overload of mineral micronutrients have adverse health effects. Trace elements facilitate numerous biochemical reactions, including those related to insulin and glucose metabolism.

The concentration of several trace elements have been reported to be altered in type 2 diabetes mellitus (T2DM) and these elements might have specific roles in the pathogenesis and progress of this disease.[12] This study was focused on the hypothesis that T2DM patients have an impaired levels of certain trace elements like copper and calcium. Transition metal like copper has affinity to bind with proteins that have been glycated. Generally, serum concentration of copper and ceruloplasmin is elevated in T2DM patients.[2]

In this study, serum copper level in type 2 diabetic subjects were found significantly increased ($p<0.002$) in than that of control group. The findings are consistent with the findings of Zargar et al.[13] Elevation of serum Cu level in hyperglycemic patients due to increase glycation, because of hyperglycemia and this will stimulate release of copper from copper rich compounds.[14] It is inconsistent with the findings of Prabodh et al.[15] Some other biological factors may be responsible for this inconsistency.

Calcium is important for insulin mediated intracellular processes in insulin responsive tissues, such as adipose tissue and skeletal muscle, and also necessary for insulin action. Further calcium is necessary for insulin receptor phosphorylation and proper signal transduction and that optimal GLUT-4 transporter activity.[16] This study showed a significant decrease in calcium level in T2DM patients in comparison to control group. This finding was in agreement with the result of Rooney et al.[17] The possible reason for decreasing calcium in T2DM is due to hypercalciuria.

Another study conducted by Lorenzo et al.[18] showed that there was no significant difference in calcium concentration between healthy group and patients group due to unknown cause.The results obtained from this study have clear implications regarding prediction of what biochemical changes occur in an individual patient has when he falls into type-2 diabetic disease. This speculation could persuade the treating physicians to take steps in correcting these biochemical changes, so that further progression of the disease could be delayed or nullified.

CONCLUSION

In this study, we found that serum copper level was significantly increased and serum calcium level was significantly decreased in type 2 diabetes patient. As a result it may be recommended that all type 2 diabetic patients should undergo regular checkup of serum copper and calcium level as routine test. Supplementation of calcium may be given in type 2 diabetic patient.

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ORIGINAL ARTICLE

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Outcome of Surgical Management of Gangrenous and Non-Gangrenous Volvulus of Sigmoid Colon

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ABSTRACT

Introduction: Volvulus is a condition in which the intestine twists around itself and the mesentery that supports it, creating an obstruction. *Approximately 5% cases of large bowel obstruction occur due to volvulus. Volvulus can occur in any part of small and large intestine including stomach. Among these sigmoid volvulus is most common. The aim of this study was to describe the management of sigmoid volvulus with reference to the type of surgical procedures performed and its outcome.* ***Methods:*** *This was an observational study carried out in the department of surgery, Shaheed Ziaur Rahman Medical College Hospital, Bogura from December 2006 to December 2009. Total thirty (30) consecutive patients of different age group of sigmoid volvulus had been taken purposively who underwent surgery after getting informed written consent.* ***Results:*** *Results showed that ages of the patients were from 18 to 68 years and maximum patients (33.3%) were from 5th decade. Total male patients were 21 (70.0%). Twenty-three (76.7%) patients were managed by Hartmann's procedure, four (13.3%) were managed by resection and primary anastomosis and three (10%) were managed by untwisting of the sigmoid volvulus and mesocolopexy. Among these operative procedures untwisting of the sigmoid volvulus and mesocolopexy (n-3) in two patients out of three with non-gangrenous colon were recovered uneventfully and one patient recovered with complication and with Hartmann's procedure (n-23), two patients out of twelve with gangrenous colon were died due to septicaemia and pulmonary complications and after resection with primary anastomosis (n-4) out of two with gangrenous colon were died due to faecal fistula and one patient with non-gangrenous bowel died due to septicaemia. Recovery rate was significantly high (p-0.0095) in case of non-gangrenous volvulus. It was also found that there is no significant (p-0.593) relation of gender with surgical outcome of sigmoid volvulus.* ***Conclusion:*** *In sigmoid volvulus, the most important determinant of patient outcome was bowel viability, late diagnosis and age of the patients. The research findings will help to establish better treatment plan as well as to reduce sufferings of the patients.*

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INTRODUCTION

Sigmoid volvulus (SV), first described by von Rokitansky in 1836,[1,2] is a condition in which the sigmoid colon wraps around itself and its own mesentery, causing a closed-loop obstruction (Figure 1).

Figure 1: Schematic diagram of Sigmoid volvulus

Volvulus can occur in any part of small and large intestine including stomach. Among those SV is most common. Approximately 5% cases of large gut obstruction occur due to volvulus.[3] Sigmoid volvulus accounts for two-third to three-fourth of all cases of colonic volvulus. The condition is permitted by an elongated segment of bowel, accompanied by a lengthy mesentery with a very narrow parietal attachment, a situation that allows the two ends of the mobile segment to come close together and twist about the narrow mesenteric base. Associated factors include chronic constipation and aging, with the average age at presentation being in the seventh to eighth decades of life. There is an increased incidence of the condition in institutionalized patients afflicted with neuropsychiatric conditions and treated with psychotropic drugs. These medications may predispose to volvulus by affecting intestinal motility. The increase incidence of volvulus in third world countries has been attributed to a diet high in fiber and vegetables.[4] The worldwide frequency is not known, but SV occurs frequently in young people in geographic areas with a high incidence of roundworm infestation.[5]

Most of the patients present with abdominal pain, distension, and absolute constipation, asymmetrically noted in upper abdomen toward right hypochondrium.[6] Predisposing factors include chronic constipation, megacolon and excessive mobility of colon. Plain abdominal radiograph findings are usually diagnostic, show a dilated air-filled sigmoid colon with an inverted U-shaped appearance or omega shaped or coffee bean shaped. Decompression may be achieved with the introduction of a sigmoidoscope. Early radiographic recognition is important to prevent mortality related to SV.[7]

Various modalities of treatment of sigmoid volvulus are available, common procedures are one stage resection and anastomosis, and two stage operations (Hartmann's procedure).[8] In two stage operation, we can do either resection or anastomosis with defunctioning loop colostomy which is closed after 6-8 weeks or resection and colostomy and closure of the distal end with anastomosis after 6-8 weeks. In the early stage deflation of the gut by insertion of flatus tube under sigmoidoscopic guidance can be tried. Failure results in an early laparotomy, with untwisting of the loop and per-anal decompression is done. When the bowel is viable, fixation of the sigmoid colon to the posterior abdominal wall may be a safer maneuver in experienced hands.[9,10]

In case of non-operative decompression and anastomotic failure in one stage resection and anastomosis procedure, resulting fistula formation leading to prolonged morbidity follows death. At present, better outcome of one stage procedure in patients with SV is achieved due to early diagnosis and treatment, better understanding of patho-physiology of the disease, better surgical technique, better post-operative management, effective antibiotics, and improvement in anaesthesia and resuscitation procedures.[11]

In this study, outcome of surgical management of gangrenous and non-gangrenous volvulus of sigmoid colon was evaluated to find out the most effective management for the patient of SV.

METHODS

This observational study was conducted in the department of surgery, Shaheed Ziaur Rahman Medical College Hospital, Bogura, during the period of December, 2006 to December, 2009.Thirty consecutive patients of different age groups of sigmoid volvulus (SV) have been taken purposively, and who underwent surgery during the study period. Strict selection criteria were applied. Patients with sigmoid volvulus proved by history, clinical examination, plain X-ray abdomen and were confirmed on laparotomy. Patients or their guardians who agreed to comply with the study protocol were included. Patient or patient's guardian who refused to be included in the study and patient who had compound volvulus (a loop of ileum wrapping around the root of sigmoid colon loop torsion) were not included in this study. Plain X-ray abdomen confirmed majority of cases and all cases were confirmed after laparotomy. Regarding treatment, initially a conservative approach was tried, such as enema simplex, and rectal tube insertion under sigmoidoscopic guidance, but later on laparotomy was done in all cases. Residents and fellow surgeons performed the operations under the supervision of senior surgeons. Data analysis was performed according to the objective of the study using computer software program and Statistical package for Social Sciences (SPSS), version 20. Level of significance was measured by using Chi-square test. A *p*- value < 0.05 was considered statistically significant.

RESULTS

In this study, ages of the patients were from 18 to 68 years. Maximum number of patients fell into 5th decade followed by 6th decade and percentage were 33.3% and 26.7% respectively (Table I).

Table I: Age groups in various decades of life (n-30)

Age groups (years)	No. of patients	Percentage (%)
11-20	1	3.3
21-30	5	16.7
31-40	5	16.7
41-50	10	33.3
51-60	8	26.7
61-70	1	3.3

All patients (n-30) of this study came to the hospital after onset of symptoms and maximum patients (53.3%) admitted to the hospital after four days to onwards (Table II).

Table II: Time of reporting after onset of symptom (n-30)

Time of reporting to hospital	No. of person	Percetage (%)
Within 24 hours	5	16.7
Within 1 to 3 days	9	30.0
Within 4 to 7 days	15	50.0
More than 7 days	1	03.3

Conditions of colon during laparotomy (n-30), 14 (46.7%) cases were gangrenous and 16 (53.3%) cases had viable colon (Figure 2).

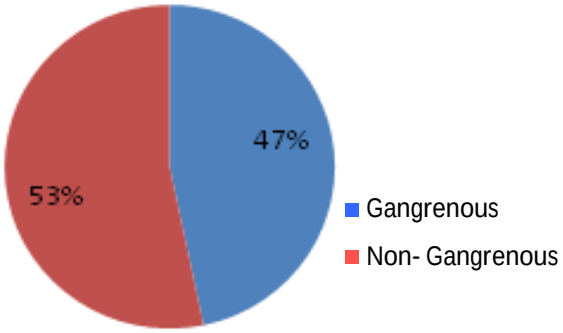

Figure 2: Condition of colon during laparotomy (n-30)

After operation, majority of the patients developed pulmonary complications 12 (40.0%) followed by wound sepsis 10 (33.3%), residual abscess 04 (13.3%) and septicemia 03 (10.0%) (Table III).

Table III: Postoperative complications after surgery (n-30)

Postoperative complications	No. of the patients	Percentage (%)
Pulmonary complications	12	40.0
Wound sepsis	10	33.3
Residual abscess	4	13.3
Septicaemia	3	10.0
Burst abdomen	2	6.7
Faecal fistula	2	6.7

*Multiple responses

Among these operative procedure (n-23, 76.7%) two patients out of twelve with gangrenous colon were died due to septicaemia and pulmonary complications after Hartmann's procedure and two patients with gangrenous colon were died due to faecal fistula after resection with primary anastomosis (n-4, 13.3%), and one patient with nongangrenous bowel was died due to septicaemia. Untwisting of the sigmoid volvulus and mesocolopexy (n-3, 10%) in two patients out of three with non-gangrenous colon were recovered uneventfully and one patient recovered with complication. Recovery rate was significantly high (*p*- 0.0095) in case of non-gangrenous volvulus (Table IV).

Table IV: Surgical outcome of gangrenous and non-gangrenous volvulus (n-30)

Condition of Bowel (n-30)	Surgical Options	Surgical outcome			*p value
		Recovered uneventful	Recovered with complications	Death	
Gangrenous Volvulus (n-14)	Untwisting and Mesocolopexy (n-0)	0	0	0	0.0095[S]
	Resection and primary anastomosis (n-2)	0	0	2	
	Hartmann`s Procedure(n-12)	3	7	2	
Non Gangrenous Volvulus (n-16)	Untwisting and Mesocolopexy (n-3)	2	1	0	
	Resection and primary anastomosis (n-2)	0	1	1	
	Hartmann`s Procedure (n-11)	9	2	0	

*Chi-square test, [S]significant

Out of 21 male patients, 17 (56.7%) survived and four (13.3%) expired. Out of nine female patients, eight (26.7%) survived and one (3.3%) expired. Total survival rate was 83.3% and mortality was 16.7%. There is no significant (p-0.593) relation of gender with surgical outcome of SV (Table V).

Table V: Mortality and survival rate according to sex distribution (n-30)

Sex	No. of Patients	Survival	Death	*p value
Male	21	17 (56.7%)	4 (13.3%)	
Female	9	8 (26.7%)	1 (3.3%)	0.593[ns]
Total	**30 (100%)**	**25 (83.3%)**	**5 (16.7%)**	

*Chi-square test, [ns]not significant

DISCUSSION

Volvulus of the sigmoid colon is the most common cause of large gut obstruction in our country. Its incidence in our country is about 56.9% of all acute large gut obstruction.[6] But in worldwide sigmoid volvulus (SV) accounts for 2% to 50% of all colonic obstructions and has an interesting geographic dispersion.[12] Sigmoid volvulus accounts for 2% to 5% of colonic obstructions in Western countries and 20% to 50% of obstructions in Eastern countries.[1,13,14] In this study, the ages of the patients were from 18 to 68 years. Maximum number of patients fell into 5th decade, followed by 6th decade and percentage were 33.3% and 26.7% respectively. Rahman[5] showed that 52% of sigmoid volvulus occurred between 50-60 years of age in our country. These results are almost similar to those of Mahmood[15] and also with Karim.[16] Gibney[17]showed in his study that the mean age of 73 patients was 50.9 years. In the elderly patients, there is coexisting serious cardiovascular, respiratory, renal, gastrointestinal, neurological, and psychiatric comorbidities and chronic constipation susceptible to SV formation.

Male are more prone to SV. In this study male to female ratio was 2.3:1. Bhatnagar et al.[18] showed male to female ratio 1.7:1 in their study. They document the anatomic measurements of the sigmoid colon in 70 Indian subjects (51 live and 19 cadavers). They showed that the sigmoid mesocolon in the male is dolichomesocholic (longer than wide), whereas the female mesocolon is brachymesocholic (wider than long). The authors hypothesize that a narrower mesocolic root with a greater vertical length of the mesocolon in the male sigmoid colon makes male more susceptible to SV.

This study reveals that, there is no significant (*p*-0.593) relation of gender with surgical outcome of SV rather related to delayed presentation and co-morbidities. During operation, we found 16 cases (53.3%) with viable colon and 14 cases (46.7%) with gangrenous colon. There are many modalities for the treatment of SV but which procedure is the best in regard to outcome is still controversial.[19] Moreover, non-operative procedures are contraindicated when gangrenous colon is suspected. The operative outcome was death of five cases out of which four were with gangrenous colon and one with non-gangrenous colon.

In this study, out of 30 patients 5 patients died. The mortality rate was 16.7%. Total three patients with non-gangrenous colon were treated with untwisting of SV and mesocolopexy. Among these, one patient developed only postoperative complication. So, mortality rate of untwisting of colon and mesocolopexy in non-gangrenous SV was nil, which was similar to Kaneria et al.[20] Stalinraja et al.[21] showed in non-gangrenous volvulus mortality rate following laparotomy and detorsion alone varies from 0-50%.

In this study, mortality rate of resection and primary anastomosis in gangrenous colon was 100% and in viable colon was 50%. Ballantyne et al.[22] reported 50% mortality in gangrenous colon and 7.5% in non-gangrenous colon. Rahman[5] showed36.2% mortality among gangrenous patients and 13.6% in non-gangrenous patients. This study showed more mortality than others,[5,22] possibly due to lack of intensive care unit facility at that time and delayed presentation.

Caroche et al.[23] showed mortality rate 44% and it concerned only the patients who had gangrenous sigmoid volvulus that were treated with primary resection and anastomosis. Conversely, none of the patients died in case of intestinal derotation and colopexy. In the subocclusive group, mortality was 35% and it increased up to 50% in those patients with a late diagnosis who underwent a

sigmoid resection. In the present study, overall mortality rate was 75% and among these, 50% occurred in patient with gangrenous colon and 25% occurred in patients with viable colon. This is somewhat higher than that of other emergency operation but almost similar with Cirocchi et al.[23] In two stage operation , two patients died out of twenty-three. The cause of death was irreversible septic shock from delayed presentation with peritonitis, leading to postoperative hypovolaemia due to poor intolerance of intravenous fluid and electrolyte balance and due to pulmonary complication in another patient but was not related to septicaemia, as there was no anastomotic leakage. Those with viable colon (n-11) no patient died. So, the mortality rate with two stage procedure was 8.7%. This mortality rate is very close to the study done by Shepherd[24] who showed 12% mortality. Eighteen patients out of 23 with colostomy came for colostomy closure after 2-3 months. All of them under went colostomy closure as elective operation. All patients were recovered uneventfully. This may be due to proper gut preparation and elective operation. Most of the patients were poor and one stage immediate resection with primary anastomosis had short duration of hospital stay but not good choice for gangrenous colon as of high mortality rate. Two stage procedures need twice admission for two major operations and twice postoperative treatments. Detorsion with mesocolopexy is good choice for non-gangrenous colon having high recurrence rate and need sigmoid resection in the same hospital stay. Comparing the results of one stage procedure to two stage procedures in relation to morbidity and mortality that one stage procedure has low morbidity and mortality in patients with viable colon.[25] But in gangrenous colon one stage operation has high mortality rate and the mortality was related to anastomotic leakage. In two stage procedure mortality was low and it was not related to anastomotic leakage. Moreover, a patient with colostomy is psychological problem to the society as well as to himself. In our country by considering the above points, one stage immediate resection with primary anastomosis should be the treatment of choice in comparison to two stage procedure when there is non-gangrenous colon. But Hartmann's procedure is justifiable in all cases of gangrenous colon to reduce the morbidity and mortality of the patients in comparison with resection and primary anastomosis.

This study was conducted in only one government medical college hospital of Bangladesh on limited number of patients. So, it did not represent the whole group of such patients. Further researches should be aimed to include a larger sample size selected from a larger number of different hospitals of different parts of the country.

CONCLUSION

It is concluded that immediate sigmoidoscopic reduction followed by elective resection of the sigmoid colon, and primary anastomosis should be the treatment of choice for viable colon. In case of failed tube decompression, immediate resection with primary anastomosis in viable gut and Hartmann's operation in gangrenous gut should be considered. This study also expressed the need of larger research in this issue and points out the importance of early intervention for volvulus patients.

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ORGINAL ARTICLE
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Clinically Diagnosed Acute Appendicitis and its Correlation with their Histopathological Findings

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ABSTRACT

Introduction: *Acute appendicitis may present with various pathological entities that claim specific approach for diagnosis andtreatment. The aim of this study is to ascertain the correlation of clinically diagnosed acute appendicitis with their histopathological findings.* ***Methods:*** *This prospective study included a consecutive total of 100 cases (Male: 48, female: 52, age range: 4.5 years to 45 years) were presented with acute appendicitis undergoing operative treatment in the department of Surgery at Medical College for Women and Hospital, Uttara, Dhaka from December, 2008 to December, 2009. Preoperative diagnosis was made from history, physical examination and relevant investigations. All the specimens of resected vermiform appendix were sent for histopathological examination to a single laboratory.* ***Results:*** *Out of 100 cases, histopathological analysis revealed acute appendicitis in 27 (27%) cases, acute suppurative appendicitis in 36 (36%) cases, acute resolving appendicitis in 31 (31%) cases, acute gangrenous appendicitis in 03 (3%) cases, appendix abscess in 02 (2%) cases and lymphoid hyperplasia in a single (1%) case. Overall diagnostic error or negative appendicectomy (i.e. normal appendix at histopathology) was zero.* ***Conclusion:*** *Diagnosis of acute appendicitis is based mostly on clinical ground. Subsequent prognosis, evaluation and management of these patients were significantly altered by the histopathological findings. This study suggests that routine histopathological analysis of resected appendix may be an obligatory step for overall management of these patients.*

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INTRODUCTION

In human being the appendix or vermiform appendix is a worm like structure of caecal wall (large intestine). It is an elongated muscular tube resembling a worm so, its nomenclature based on the Latin word 'vermiform' which means 'worm shaped'. Its function in the human body is not fully established yet. Scientists believe it is a vestigial remnant. Some claimed that the appendix is rich in lymphoid tissues (abdominal tonsil), which help the body to fight against infections; hence it could have a role in the body's immune function.[1] Acute appendicitis is the most common cause of an acute abdomen and appen-

dicectomy is the most frequently performed urgent abdominal operation.[2] Modern radiographic imaging has improved diagnostic accuracy but the diagnosis of acute appendicitis remains essentially clinical.[3]

The diagnosis of acute appendicitis can create a challenge to the most experienced clinicians even with structured scoring i.e., the Alvarado score and computer-aided systems i.e., Computed Tomography (CT)scan[4] and negative appendicectomy rates may found up to 20%[5] in some centres. Ultrasonographically diagnosis of acute appendicitis by the experienced hands can be accurate but false negative diagnosis can occur.[6] Moreover, it helps to exclude gynaecological pathology.[7,8] Computed Tomography is the investigation of choice for the diagnosis of acute appendicitis, with reports of up to 100% accuracy and negative appendicectomy rates of 7%.[9]

The most useful diagnostic procedure is laparoscopy for the exclusion of gynaecological pathology in case of a young female. Laparoscopic appendicectomy has shown to reduce negative appendicectomy rates as well as post-operative morbidity compared to open procedures.[10] Some clinicians advocate delaying surgery to improve diagnostic accuracy in selected doubtful cases; however, there have previously been reports that may lead to increased perforation rates[11] and significant mortality.[12-14]

Occasionally, the appendix is the site of tumours such as carcinoid or adenocarcinoma and may become involved in inflammatory diseases of caecum and ileum such as tuberculosis, typhoid and Crohn's disease.[15] It is also reported that appendix is the common site for melanosis at autopsy[16] and most common site for gastrointestinal carcinoid tumour.[17] There is an association between mucosal hyperplasia of appendix and adenocarcinoma of colon.[18] Lymphoid hyperplasia itself predispose to acute appendicitis by obstructing the appendiceal lumen.[19] Other than acute appendicitis, appendix may present with various pathological conditions that needs specific approach for diagnosis and different modalities of treatment. Evaluation, management and prognosis of these patients were significantly altered by the histopathological findings. So, the aim of this study was to ascertain the correlation of clinically diagnosed acute appendicitis with their histopathological findings.

METHODS

This prospective study included a consecutive total number of 100 cases (Male: 48, female: 52, age range: 4.5 years to 45 years) were presented with acute appendicitis undergoing operative treatment in the department of surgery at Medical College for Women and Hospital, Uttara, Dhaka from December, 2008 to December, 2009. Preoperative diagnosis was made from history, physical examination and relevant investigations that included complete blood count, urine for routine and microscopic examinations, X-ray KUB and ultrasonography. After diagnosis appendicectomy was done for every cases. All the specimens of resected vermiform appendix were sent for histopathological examination to a single laboratory. Data for this study, were collected in a preformed data collection sheet about the post-operative recovery, histopathological diagnosis, subsequent management and outcome of treatment of acute appendicitis. Utmost importance was emphasized on histopathological diagnosis for further management. Statistical analysis of data was done by using computer based program Statistical Package for Social Science (SPSS), version 20.

RESULTS

Age ranged from 4.5 years to 45 years with maximum incidence in 2nd and 3rddecade of life.Out of 100 cases, 48 (48%) patients were male (M) and 52 (52%) patients were female (F) with M: F ratio of 1:1.08 (Table I).

Table I: Age and Sex distribution of patients (n-100)

Age range (Years)	Sex		Number of patients	Percentage (%)
	Male	Female		
0-10	01	00	01	01
11-20	12	17	29	29
21-30	24	29	53	53
31-40	07	05	12	12
41-50	04	01	05	05
Total	**48**	**52**	**100**	**100**

Majority of patients complained of onset of pain around umbilicus (86, 86%) and anorexia (82, 82%). The next predominant symptoms were pain migrated to right iliac fossa (76, 76%) and nausea (78, 78%) (Table II).

Table II: Distribution of patients by clinical symptoms (n-100*)

Clinical symptoms	Number of patients	Percentage (%)
H/O onset of pain around umbilicus	86	86
Pain migrated to right iliac fossa	78	78
Anorexia	82	82
Nausea	76	76
Vomiting	68	68

*Multiple responses

Assessment of clinical signs shows that majority of the patients exhibited tenderness in right lower abdomen (93, 93%), pointing sign (86, 86%), rebound tenderness (79, 79%), Rovsing's sign (78, 78%) and elevated temperature (78, 78%). Other less common signs were muscle guard/rigidity (45, 45%) and tenderness on digital rectal examination (15, 15%)(Table III).

Table III: Distribution of patients by clinical signs (n-100*)

Clinical signs	Number of patients	Percentage (%)
Tenderness in right lower abdomen	93	93
Pointing sign	86	86
Rebound tenderness	79	79
Rovsing's sign	78	78
Muscle guard/rigidity	45	45
Elevated temperature (>99.14^{0}F)	78	78
Psoas sign	12	12
Dysuria	07	07
Diarrhea	04	04
Vaginal discharge	05	05
Digital rectal examination-Tender	15	15

*Multiple responses

Macroscopically per-operative findings of resected appendix out of 100 cases, 75 (75%) patients found to have inflamed appendix, 4 (4%) patients had gangrenous appendix, 2 (2%) patients had perforated appendix and 19 (19%) patients hadnormal looking appendix. Histopathological analysis revealed majority (36, 36%) of the cases were acute suppurative appendicitis, 31 (31%) cases were acute resolving appendicitis and 27 (27%) cases were acute appendicitis (Table IV).

Table IV: Per-operative and histopathological findings of appendix

Peroperative findings	Percentage (%)	Histopathological findings	Percentage (%)
Inflamed Appendix (n-75)	75	Acute suppurative appendicitis	35 (46.7%)
		Acute resolving appendicitis	27 (36%)
		Acute appendicitis	13 (17.3%)
Gangrenous Appendix (n-04)	04	Acute gangrenous appendicitis	03 (75%)
		Acute suppurative appendicitis	01 (25%)
Perforated Appendix (n-02)	02	Appendix abscess	02 (100%)
Normal looking Appendix (n-19)	19	Acute appendicitis	14 (73.6%)
		Acute resolving appendicitis	04 (21%)
		Lymphoid hyperplasia	01 (5.3%)

During operation after splitting open the lumen of the resected appendix also showed fecolith in 35 (35%) cases.

Over all among 100 cases, histopathological analysis revealed acute appendicitis in 27 (27%) cases, acute suppurative appendicitis in 36 (36%) cases, acute resolving appendicitis in 31 (31%) cases, acute gangrenous appendicitis in 03 (3%) cases, appendix abscess in 02 (2%) cases and lymphoid hyperplasia in a single (1%) case (Table V).

Table V: Histopathological findings of resected appendix (n-100)

Diagnosis based on histopathology	Number of patients	Percentage (%)
Acute appendicitis	27	27
Acute suppurative appendicitis	36	36
Acute resolving appendicitis	31	31
Acute gangrenous appendicitis	03	03
Appendix abscess	02	02
Lymphoid hyperplasia	01	01
Total	**100**	**100**

After histopathological analysis, out of 100 cases, over all correct diagnosis (appendicitis) was made in 100 cases (100%). There was no negative appendicectomy.

Post-operative recovery was good and there was no mortality, and morbidity was also negligible. Only seven (7%) patients had superficial wound infections, which were treated appropriately. All patients were healthy on subsequent follow up.

DISCUSSION

The diagnosis of acute appendicitis remains mostly on the basis of clinical manifestation. However delay in diagnosis leads to increased rates of morbidity and mortality. It is a clinical entity with an ongoing diagnostic challenge. Histopathological examinations are the gold standard for the final diagnosis, which has revealed much unusual, unexpected serious underlying pathology.

Acute appendicitis is the most frequent cause of persisting progressive abdominal pain in teenagers and appendicectomy represent about 1% of all surgical operations now.[15] It is a disease of the young[20-23] and this statement is reinforced by the current study in which 53% cases occurred in 3rd decade and 29% cases occurred in 2nd decade of life. The peak incidence of acute appendicitis is in the second decade of life.[24] However, no age is immune and the age range in this study was 4.5 years to 45 years. In all age groups, there was a well established bias towards male patients and young male patients constituted the majority of the cases. The observations are similar to those of observed in other studies.[20,21,25,26]

A female predominance was observed here with male female ratio of 1:1.08. The incidence of appendicitis is equal among males and females before puberty. In teenagers and young adults, the male female ratio increases to 3:2 at age 25; thereafter, the greater incidence in male declines.[3] The highest female incidence is in the 15 to 19 years of old age group.[27]

In this study, clinical findings revealed migratory pain 78%, anorexia 82%, nausea/vomiting 76%, elevated temperature 78%, localized tenderness in right iliac fossa 93%, rebound tenderness 79%, rovsing's sign 78%, psoas sign 12% cases. But in a retrospective review of the 211 consecutive suspected appendicitis cases, there, migratory pain was in 79.0%, anorexia 91.9% and nausea/vomiting in 74.7% cases.[10] These findings are very much consistent with our findings.

Obstruction of appendiceal lumen by fecolith or lymphoid hyperplasia is said to be of importance in the pathogenesis of acute appendicitis.[28-31] In this study, during operation after splitting open the lumen of the resected appendix also showed fecolith in 35% cases. This is consistent with the report of Burkitt[32] who found fecolith in 40% cases. Evidence of perforation observed in 02% cases as compared to other studies which have reported a perforation rate 3.6% to 26%.[21,29] It has reported that elderly patients with appendicitis seek medical attention later than the young.[33] This significant delay before surgery resulted in high rate of complicated appendicitis in older age group because early loss of appendiceal blood supply.

During operation, 81 patients found to have macroscopically pathological appendix, 19 patients had normal looking appendix and histopathological analysis found as various types of acute inflammation of appendix in all cases. Apparently normal looking appendix may show different degrees of inflammation on histopathological examination.

Negative appendicectomy may be found in any study but this study shows no negative appendicectomy. This finding is compared with other studies which have reported a negative appendicectomy rate of 07% to 12%.[34-39] There is an agreement that even highly competent surgeons may do false positive diagnosis of acute appendicitis and remove normal appendices up to 20% cases.[40]

As the appendix may present with various pathological conditions such as carcinoid or adenocarcinoma and may become involved in inflammatory diseases of caecum and ileum such as tuberculosis, typhoid and Crohn's disease, apart from acute appendicitis, but the present study show no such diseases of appendix rather than appendicitis. Here found varieties of acute inflammatory diseases of appendix such as acute appendicitis, acute suppurative appendicitis, acute resolving appendicitis, acute gangrenous appendicitis, appendix abscess and lymphoid hyperplasia.

CONCLUSION

Correlation of histopathological findings with the clinically diagnosed acute appendicitisis necessary because, it may be associated with various pathological conditions like carcinoid tumor, tuberculosis, adenocarcinoma etc.

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CASE REPORT
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Bilateral absence of Musculocutaneous Nerve with Innervations of Muscles in Anterior Compartment of Arm from Lateral Cord of Brachial Plexus: A Case Report

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ABSTRACT

The musculocutaneous nerve (MCN) originates from the lateral cord (LC; roots C5-C7) of brachial plexus (BP). It is the nerve of anterior compartment of arm, supplies the muscle and continues as lateral cutaneous nerve of the forearm (LCNF). The aim of this report is to discover the existence of MCN and to categorise the alternative supply of the muscles of front of arm. During routine dissection of 45-years old formalin-fixed female cadaver at the department of anatomy, North Bengal Medical College, Sirajganj, an unusual absence of MCN and alternative innervations of muscle of front of arm from LC of BP was noted bilaterally. The muscular innervations come separately from LC. The nerve to the brachialis (Br) muscle after its innervations continues as LCNF. Formation of median nerve (MN) by the union of lateral and medial root did not take place in the axillary fossa, occurred in upper arm but it was at lower level on the left side than the right side. This anatomical variation of innervations in the front of the arm is very significant to the anatomist and clinician. For this reason, the present case report is very important from anatomical, clinical and embryological point of view.

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INTRODUCTION

The brachial plexus (BP) variations have been noted by several authors. It should be noted that BP is the most variable portion of the peripheral nervous system and its degree of variations ranges from 12.8% up to 53%.[1,2] Musculocutaneous nerve (MCN) is the nerve of the anterior compartment of arm. It arises from the lateral cord (LC; roots C5-C7) of BP, follows the course of the third part of the axillary artery (Ax Ar). Just opposite to the lower border of pectoralis minor it penetrates the coracobrachialis (CB) muscle and then passes downwards and laterally between the biceps brachii (BB) above and the brachialis (Br) muscles below and supply to them. About 2 cm above the bend of elbow it pierces the deep fascia, lateral to the tendon of the BB and continues as lateral cutaneous nerve of the forearm (LCNF).[3-5] Variations of the MCN may occur in 6.25% cases[6] and its absence has

been reported with a prevalence ranging from 1.7 to 15%.[7] Absence of MCN has been stated in many reports.[8,9] Prasada Rao et al[10] claimed that MCN was found to be absent. Further, BUCH-HANSEN[11] endorsed these variations in 65% of population. Lateral cord (LC) of BP has three braches i.e. lateral pectoral, nerve to CB and lateral root of median nerve (MN). Muscles in anterior compartment of arm, i.e., CB, both heads of BB and greater medial part of Br are supplied by MCN. Small lateral part of Br also receives branches from radial nerve (RN). MN is formed by the union of lateral and medial roots from lateral and medial cord of BP but it has no muscular branch for the flexor muscles of front of arm.[12] Dissimilarities in upper limbs, especially in its nerves, vessels and muscles are common and have been asserted by many authors.[13-15] In this regard, variation in the formation of BP, its branches, course and distribution is a great interest for all the clinicians. Knowledge of such normal anatomy, the dissimilarities of BP and its branches in the upper limb is very significant to the surgeons for carrying out surgical procedures.[16] Alterations of peripheral nerves are important to orthopaedic surgeon, neurophysician, physiotherapists and radiologists. Such understanding is useful in nerve grafting and neuron physiological evaluation for diagnosing peripheral neuropathies.[17]

The aim of the present study was to discover the bilateral absence of MCN and alternative innervations of muscles in the front of arm from lateral cord of BP.

The Case

During routine dissection of the arm for the undergraduate students, approximately 45-years old formalin-fixed female cadaver at the department of anatomy, North Bengal Medical College, Sirajganj, an unusual absence of musculocutaneous nerve (MCN) and alternative innervations of muscles of front of arm from lateral cord (LC) of brachial plexus (BP) was noted bilaterally. So, this paper reports on bilateral absence of MCN and alternative muscular innervations of front of arm from the LC of BP.

In the left side, nerve to the coracobrachialis (CB) arises 08 centimetres (cm) distal to the outer border of the first rib from the LC of BP and further 04 cm away, nerve to biceps brachii (BB) appears (i.e. 12 cm from outer border of the first rib). But the brachialis (Br) is supplied by another direct branch from LC about 13 cm from the outer border of the first rib (Figure 1a, 1b).

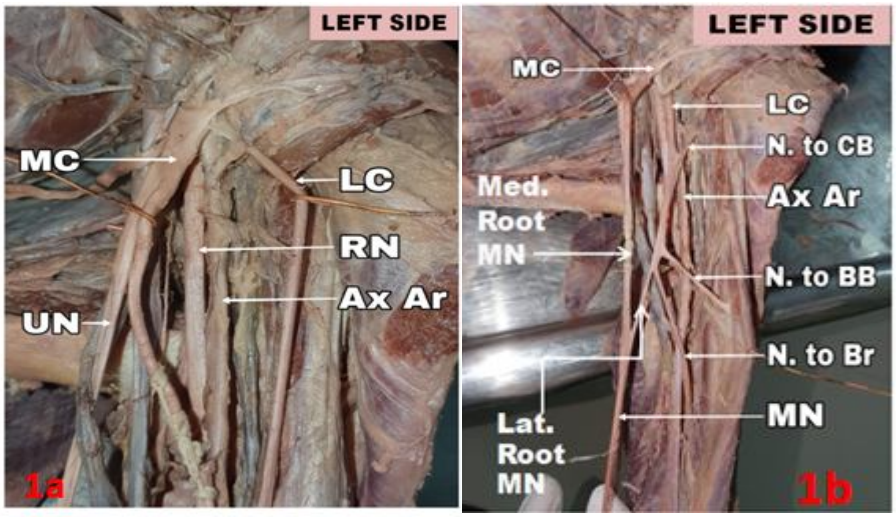

Figure 1: (1a) Photograph of front of the arm (Left side) showing different cords of Brachial plexus (BP)
(1b) Innervations of muscle with the formation of Median nerve (MN)

Then the LC continued as lateral root of median nerve (MN). After supplying Br muscle, the nerve passes downward between the BB and Br muscles to the lower part of the arm, crossed the elbow joint and pierces the deep fascia lateral to the BB tendon and emerged out just as the lateral cutaneous nerve of the forearm (LCNF).

In the right, nerve to the CB is given from LC 09 cm distal to the outer border of the first rib. 14 cm away from the outer border of the first rib, three branches appeared at the same point from the LC in arm, one branch for the BB, one branch to the Br, then the last one continued as lateral root of the MN (Figure 2a, 2b).

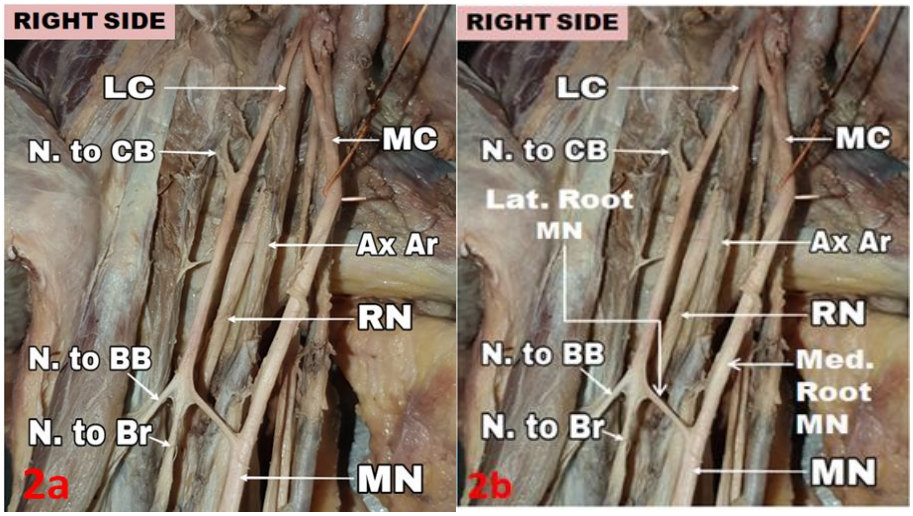

Figure 2: (2a) Photograph of front of the arm (Right side) showing different cords of Brachial plexus (BP)
(2b) Innervations of muscle with the formation of Median nerve (MN)

The nerve to the Br muscle passes through it and then the nerve become continuous as the LCNF as in the opposite side (Figure 3).

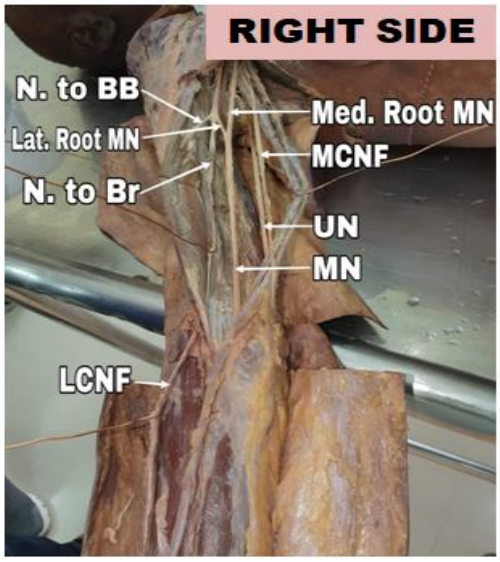

Figure 3: Photograph of front of the arm (Right side) showing nerve to brachialis (Br) continuous as lateral cutaneous nerve of forearm (LCNF)

Union of two roots of MN did not unite in the axillary fossa but in upper arm which was at lower level on the left side than the right side.

DISCUSSION

Anatomical variations of the BP have been reported by many researchers in the past. But in the present study, we are reporting unique findings related to lateral cord (LC). Our study was aimed to provide additional knowledge on LC variations to clinicians and surgeons. This might help to avoid damage during surgical procedures involving the nerves of upper limb as in plastic and reconstructive surgery. The MCN and the MN are two major nerves which have numerous variations in their formation and branching patterns. The MCN is one of the three terminal branches of LC of the BP which after piercing the CB, innervates the musculatures of anterior compartment of arm and continues as LCNF.[3-5] Union of two roots of MN did not unite in the axillary fossa but in upper arm which is identical with the finding of author.[11]

There is adequate number of evidences about the absence of MCN.[8, 9,13,18,19] It has been opined that absence of MCN may not lead to paralysis of the flexor compartment of the arm since the motor and sensory fibres can arise from other nerve. In the present study, in both limbs, the MCN was absent but the above muscles were supplied by direct branches from the LC of BP. Complete absence of MCN have been reported by Bhojak et al.,[20] in 4% of cases and Jamuna et al.,[21] observed it in 6% of their cases. Their findings are supported by few other authors.[13,22,23] In the present study, CB of both arm is supplied by branch from LC, which is acknowledged by the authors[13] in their study. But Sarkar et al.,[24] mentioned that only left CB is supplied by a twig from LC.

In this study, the branch to the Br from LC after supplying the muscle becomes continuous as LCNF in both limbs. But Sarkar et al.,[24] in their study mentioned that in absence of MCN after supplying to Br muscle that branch of the MN is continuous as LCNF similar to other studies. Their findings represent this dissimilarity.

Knowledge of such anatomical variations is very significant both to the anatomist and clinician. From clinical, embryological and anatomical point of views the present case report is very important. This atypical feature can help surgeons in safe surgical exploration of axilla; thus inadvertent injuries can be avoided during nerve block of infraclavicular part of brachial plexus.

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CASE REPORT
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Mesenteric Vascular Injury Following Blunt Abdominal Trauma: A Case Report

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ABSTRACT

Trauma originates from the Greek word meaning 'wound'. It implies that a physical force exerted on a person has led to a physical injury. A wound of the mesentery can follow severe abdominal contusion and is a cause of haemoperitoneum. The mesenteric vascular injury following blunt abdominal trauma as a result of road traffic accident is rare and may cause small bowel infarction if injury in the more distal vessels. Delay in reaching hospital, delay in diagnosis, or late operative intervention could lead to increased morbidity, prolonged hospital stay and even mortality. Here we report a case of such injury with subsequent segmental small bowel infarction. A 28 years old male patient was admitted in emergency department of North Bengal Medical College Hospital (NBMCH), Sirajganj, Bangladesh, with the complaint of severe abdominal pain due to road traffic accident (RTA) twenty-four hours back. On examination, he was anxious but well oriented. Moderately pale, mild dehydrated, Pulse 124/minute, blood pressure 80/50 mm Hg, Respiratory rate 24 b/minute, abdomen was distended with an abrasion near the umbilicus and abdomen was tense, tender with guarding and rigidity. Bowel sound was absent. Haemoglobin (Hb)- 9.5 gm/dl, plain X-ray Chest, abdomen and pelvis revealed normal, abdominal ultrasound showed moderate amount of collection in the peritoneal cavity. After adequate resuscitation, the patient was referred to surgery department from emergency ward. Then emergency laparotomy was done, followed by resection of the infarcted bowel segment with double barrel ileostomy. We highlight the various techniques for timely diagnosis and management of isolated mesenteric vascular injuries. A high index of suspicion, early detection and prompt surgical intervention is required when there are minimal symptoms and signs, which might avoid adverse outcome.

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INTRODUCTION

Trauma is the most common cause of disability and death in children and young adults in the developed countries. Approximately 10000 people die daily as a result of an injury. Road traffic accidents (RTA), falls and intentional violence have been identified as the major causes of traumatic injury. The major bur-

den of injury is increasing in developing countries due to industrialization and motorised transportation. Major trauma affects approximately 15% of all injured patients.[1]

Injuries and deaths due to RTA are a major public health problem in developing countries. More than 85% of all deaths and 90% of disability occurred from road traffic injuries. Almost 30% of them are no longer able to return to their previous occupation and a great deal of time is lost from work. It should be emphasised that an injury not only affects the injured person but also affects everyone who is involved in the injured person's life.[2] Mechanism of abdominal trauma may be blunt, penetrating or even of a combined nature. Blunt trauma accounts for more than 80% of all abdominal traumas, resulting in a rate of intra-abdominal injury of approximately 18%. The incidence of blunt trauma is increasing due to the increasing rate of automobile and motorcycle accidents. The car remains the cause of the majority of blunt abdominal trauma.[3] Particular care should be taken if a seat-belt sign is found, as the presence of an abdominal seat belt sign is associated with a significant increase in intra-abdominal injuries. Hollow visceral particularly the duodenal, and mesenteric injuries are markedly increased.[4] The initial assessment of the trauma patient, besides the clinical examination, should include analysis of the interactions between the patient, the mechanism of injury and the extent of the injury sustained. The abdominal examination may be supplemented by diagnostic imaging including Focused assessment with sonography for trauma (FAST), Plain radiographs, Computed tomography (CT) scan and also Diagnostic peritoneal aspiration (DPA)/Diagnostic peritoneal lavage (DPL), Laparoscopy for both diagnostic and therapeutic purpose.[5] Initial management of trauma patient is according to the Advanced Trauma Life Support (ATLS) system delineates an order of priorities set by cABCDE; that is control of exsanguinating external haemorrhage, airway, breathing, circulation and disability and exposure.[6] In blunt abdominal trauma following road traffic accident (RTA), patient needs multidisciplinary team approach and requires aggressive resuscitation, prioritization of injury work-up and definitive treatment.

The Case

A 28 years old male hailing from Sirajganj, Bangladesh, presented to emergency department of North Bengal Medical College Hospital (NBMCH), Sirajganj, with the history of road traffic accident (RTA) followed by severe abdominal pain. He was pushed by a vehicle and was pressed in between the vehicle and a tree followed by sustained injuries to the abdomen. Initially the patient was admitted and treated in tertiary level Hospital, Sirajganj and was referred out when the general condition deteriorated. He was received at North Bengal Medical College Hospital 24 hours after RTA in an unstable condition. On physical examination, patient was anxious but well oriented, moderately pale, mildly dehydrated, pulse rate 124/minute, low in volume and blood pressure 80/50 mm of Hg, body temperature normal. He was tachypneic. Airway was patent. Abdomen was distended and an abrasion nears the umbilicus, tense and tender abdomen with guarding and rigidity. Bowel sounds were absent. There was no other associated external injury, digital rectal examination revealed normal, decreased urine output with high colour. Rest of the systemic examination revealed normal. Investigation showed, Haemoglobin (Hb)-9.5 gm/dl, moderate amount of collection in the peritoneal cavity with dilated bowel loops suspicious of haemoperitoneum on abdominal ultrasound. Plain X-Ray chest, abdomen and pelvis revealed normal. Patient underwent emergency exploratory laparotomy five hours after admission following initial resuscitation. Laparotomy was done through

midline incision. At laparotomy, once the abdomen was opened obvious blood and clot was removed and all four quadrants were packed with sponges. The sponges were then sequentially removed to localized sources of bleeding and contamination. There was a single wedge shaped distal small bowel mesenteric tear with no active bleeding (Figure 1) and adjacent almost 20 cm of the ileum was gangrenous (Figure 2), approximately 20 cm of distal ileum and remaining proximal ileum including jejunum was viable but swollen and oedematous.

Figure 1: A single wedge shaped tear in small bowel mesentery

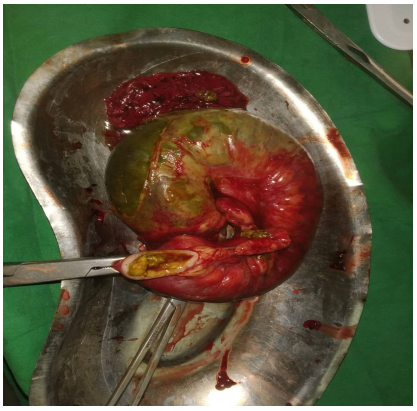

Figure 2: Resected specimen of ileum

Bowel perforation or other intra-abdominal visceral injury was absent. After thorough peritoneal toileting with normal saline, resection of the gangrenous segment of ileum with two centimetres both proximal and distal healthy margin than double barrel ileostomy was done using 2/0 polyglactin. Gangrenous segment of bowel sent for histopathological examination. Two large bore intra-peritoneal drains were given and kept in situ for seven days.

Four units of whole blood were transfused during intra-operative and post-operative period. Patient was kept on parenteral nutrition for two days. Post-operative recovery was uneventful. He was discharged on the 20th post-operative day (POD) with an advice for high carbohydrate and low fat diet. Histopathology showed infarcted ileum with viable tissue at the resected ends. After three months of first surgery extra-peritoneal ileostomy closure was done and discharged on 13th POD. Patient is now on routine follow up and he is alright even after nine months of surgery.

DISCUSSION

The small bowel is frequently injured as a result of blunt trauma. The individual loops may be trapped, causing high pressure rupture of a loop or tearing of the mesentery. Abdominal vascular injuries following blunt trauma are uncommon as compared to penetrating wounds of the abdomen. Isolated the mesenteric injury with subsequent small bowel infarction after Blunt Abdominal Trauma (BAT) in road traffic accident has a further rare incidence.[7] Undiagnosed mesenteric injuries are associated with high morbidity and mortality rates due to life-threatening haemorrhage from disruption of mesenteric vessels, bowel infarction and peritonitis.[8] The mechanisms of injury in blunt abdominal trauma include direct blunt force against bony surfaces such as the spine or pelvis, acceleration / deceleration injury, 'burst' injury and laceration from broken rib, pelvis or spine fragments.[3] Mechanism of this case involved direct compression forces and patient was trapped between vehicle and a tree.

The patient's physiology must be assessed at regular intervals and, if there is an indication that the patient is still actively bleeding, then the source must be identified. Clinical manifestations of patients with isolated mesenteric vascular injury include features of intra-abdominal bleeding and peritoneal irritation. Blood loss into the abdomen can be subtle and there may be no clear clinical signs. Blood is not an irritant and does not

initially cause any abdominal pain. Distension is subjective, and a drop in the blood pressure may be a very late sign in a young fit patient. The delayed and late manifestations might be due to sepsis, bowel infarction and bowel stenosis or adhesion formation. Abdominal pain, tenderness, distension, hypotension and shock are non-specific clinical findings in mesenteric blunt trauma injuries. Sometimes retroperitoneal haematoma ensues with minimal abdominal signs and the injury may remain unrevealed until hypovolemic shock develops.[9] Abdominal assessment should be systematic and orderly. The abdominal wall should be inspected for seat belt signs, abrasions, ecchymosis, lacerations, wounds and foreign objects. Seat belt sign refers to a mark on the abdominal wall along the strap site which varies from mild bruising or haematoma formation to even fat and muscular disruption.[4]

In this case, patient presented with history of road traffic accident (RTA) followed by hypovolemic shock and skin abrasion on abdominal wall-though the absence of this sign does not exclude intra-abdominal vascular or visceral injury. Furthermore, in patients with concomitant head and spinal cord trauma and in those with a decreased level of consciousness, physical assessment for intra-abdominal injury might not be reliable.[5]

In this case, patient was conscious and oriented. Patient may remain asymptomatic with non-specific clinical signs during initial evaluation.[10] Thus; sole dependence on clinical parameters can lead to unacceptable diagnostic delays. Moreover, surgical intervention based entirely on physical examination has a high negative laparotomy rate of 40%.[8] Availability of tertiary trauma care facilities and diagnostic procedures are crucial to the management of accident victims.

Jansen et al.[5] suggested a low threshold for investigations in blunt abdominal trauma (BAT) as almost 10% of patients show no clinical signs of injury and radiological evidence of abdominal injury. Choice of imaging is determined by the clinical condition of the patient. Unstable patients with isolated abdominal trauma may have multiple sources of haemorrhage and it is necessary to identify the correct cavity for exploration prior to transfer to the operating theatre. In BAT, the best and most sensitive modality is CT scan with intravenous contrast; however, in the unstable patient, this is generally not possible.

Focussed assessment with sonography for trauma (FAST) remains the most rapid, non-invasive and repeatable modality for determining the presence of free fluid in the abdomen. At least, 200-300 ml of blood must accumulate before it can be reliably seen on FAST. Hollow viscus and mesenteric vascular injury are difficult to diagnose, even in experienced hands. A positive FAST in the hypotensive blunt trauma patient warrants immediate exploratory laparotomy. DPA/DPL is a highly accurate test for detecting haemoperitoneum if the FAST is negative.[3] Patients with a positive diagnostic peritoneal aspiration (DPA), defined as aspiration of 10 ml or more blood or aspiration of succus, or a grossly positive diagnostic peritoneal lavage (DPL) should be taken immediately for surgical exploration. Its drawbacks include risk of visceral injury (0.6%) and high rate (36%) of non-therapeutic laparotomy.[11] Nowadays, DPL has largely been replaced by extended Focused assessment with sonography for trauma (eFAST).[12] However, mesenteric injuries might be missed by ultrasound; therefore, it is not preferred in haemodynamically stable patients of BAT in comparison to Computed Tomography (CT) scan.[8]

CT scan has become the 'gold standard' for the intra-abdominal diagnosis of injury in the stable patient. Advantages of CT scan include high sensitivity and specificity up to 90-100% for blood and individual organ injury.[12] Multidetector CT can determine the source of haemorrhage by detecting arterial contrast extravasation and may assist in determination of operative intervention. Free peritoneal fluid, infiltration of mesenteric fat, mesenteric haematoma, vascular beading and abrupt termination of mesenteric vessels are the features that can be marked in CT but identification of mesenteric vascular injury is not possible by abdominal ultrasound.[13] An entirely normal abdominal CT is usually sufficient to exclude intra peritoneal injury. Laparoscopy may be a valuable screening investigation in stable patients as well as therapeutic goal. Plain X-ray places a limited role in the evaluation of BAT. Abdominal radiographs are usually unnecessary. X-ray chest and

pelvis are often obtained to evaluate for concurrent thoracic or pelvic injuries.

This case was assessed by Ultrasonogram of Whole abdomen, plain radiograph, DPA and some laboratory investigations. CT scan was not done due to insufficient facilities.

Approximately 25% of all abdominal trauma patients will require a laparotomy at some point during their hospital stay. BAT requires exploratory laparotomy in only 4% of cases but accounts for 78% of trauma admissions. Mesenteric vascular injury is clarified either proximal or distal, proximal vascular injury may not be associated with ischaemia of bowel due to extensive collateral circulation. If primary repair is not possible, then the vessels are ligated. Distal vascular injury may be associated with bowel ischaemia and may need ligation of the vessels and resection of bowel. Injuries of the small intestine occur in approximately 15-20% of patients who require laparotomy after blunt trauma.[3] At operation, haemostasis is the first priority, and then the small bowel should be examined from the ligament of Treitz to the ileocaecal valve. The bowel wall and the mesentery should both be examined for defects, lacerations or haematomas. Small lacerations can be closed primarily. Large lacerations, macerated tissues, infarcted bowel or multiple injuries benefit from resection and primary anastomosis. After controlling mesenteric bleeding, the viability of the involved bowel should be carefully assessed. If, at the end of this period, there is still uncertainty about gut viability, the gut should be resected and if the patient is septic, consideration should be given to raising both ends of the bowel as stomas.[14] This is not only safe but also allows regular assessment of the bowel. Mesentery defects due to injury or following bowel resection and anastomosis should be closed to prevent internal herniation.

Laparotomy is indicated in presence of generalized peritonitis, haemoperitoneum without evidence of solid organ injury, CT signs of significant bowel or mesenteric injury and clinical deterioration during observation. In this case, exploratory laparotomy was done only on the basis of clinical assessment and ultrasound reports.

Conservative approach required close monitoring of physical signs and urine output, radiological evidences, paracentesis findings and a re-evaluation using CT scan. Treatment of mesenteric vascular injuries includes volume resuscitation, rapid exposure of injuries, arterial anastomosis and resection of infarcted bowel. Though there are multiple surgical options in treating mesenteric vascular injury, management depends upon per operative findings such as viability of the gut, site of vascular injury, general conditions of the patients and available facilities. Here, resection of infarcted part of ileum and double barrel ileostomy was done to avoid leakage of primary anastomosis and second time laparotomy for end ileostomy closure. Resection of more than 100 cm of terminal ileum may occasionally lead to bile salt mal-absorption and diarrhoea. Residual length of small bowel less than 70-100 cm results in short bowel syndrome, requiring long term parenteral nutrition.[15]

Major complications following small bowel injury include abscess, anastomotic leakage, enterocutaneous fistula, wound infection, paralytic ileus and anatomical obstruction.[3] Most cases respond to conservative management. Stoma complications are underestimated and common such as skin irritation, prolapse, retraction, ischaemia, stenosis, parastomal hernia, bleeding and fistulation.[16]

No complication developed in this case except superficial wound infection, which was managed conservatively. Adequate resuscitation, prompted suspicion, proper management and post-operative nutritional support enhance the early recovery and prevent major complications.

Trauma can affect all age groups. The severity of injury depends on the type and nature of the applied mechanical force. Early assessment and management of patients with multiple injuries is carried out using the ATLS protocol and other guidelines developed either locally or at national level. Surgical decompression can be organised speedily, reducing the risk of morbidity and mortality. In this situation, if the time taken to make the diagnosis was prolonged and the clinical signs had presented prior to treatment intervention, it might be too late to prevent death of the patient.

CONCLUSION

It is not easy to recognize a traumatic injury to the mesentery after blunt abdominal trauma (BAT) as many injuries may not manifest during the initial assessment and physical examinations, which are neither sensitive nor specific. Furthermore, missed diagnosis is associated with increased morbidity and mortality as seen in many cases. Judicious selection of appropriate investigations along with clinical judgement is of immense value in determining prognosis in trauma patients. Early detection and emergency surgical intervention when necessary might avoid poor outcome in mesenteric injuries.

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Acknowledgments

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