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Evaluation of Pre and Post Hypertension and Diabetes in Patients Undergoing Toe Amputation Due To Gangrene: An Original Research

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ABSTRACT

Aim: Purpose of our research was to measure specific co-morbidities in patients before and after amputation in a patient suffering from gangrene.

Methodology: 25 patients aged between 40-65 years of age, who were undergoing below knee amputation due to gangrene and suffering from hypertension as well as diabetes mellitus were included in the study. Pre and post surgical level were noted in them in relation to blood pressure level, random blood glucose, serum cholesterol, HbA 1c, CRP levels. Student t-test was carried on these continuous variables and statistical analysis was carried out with the help of SPSS 25.0.

Results: We observed that glycemic control improved with sugar levels returning to near normal which could be medically managed with 68% having RBS level below 200 mg/dl post surgically. (0.61±0.33) Around 38.5% of cases had reduction in their blood pressure level from high to moderate level immediately post-surgery and rest in 2-3 days after surgery. (0.56±0.34)

Conclusion: It was evident that after amputation of gangrenous part, not only the inflammatory damage but the vitals improved under controlled medical management.

Keywords Diabetes, Infectious foot gangrene, Below knee amputation

INTRODUCTION

Amputations of lower limbs in diabetic patients are more common than in non-diabetics and five out of six amputations occur in diabetes.[1] Statistics reveal that 25% of the hospital admissions among diabetics are for the foot lesions and of those presenting with diabetic foot, 40% require amputations.[2] 50-70% of all non-traumatic amputations occur in diabetics.[3]

The management includes control of diabetes, infections and assessment of the vascular status. This can be done by clinical assessment of the venous filling time and measurement of ankle brachial index as calculated by the hand held Doppler. A Doppler spectrum analysis will reveal spectral broadening, increase in the peak systolic velocity and a monophasic wave

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pattern.[4] The extent of infection in the tissue planes and the underlying tissues was assessed by plain X-ray of the part but CT scan, MRI or radionuclide scan was rarely used.[5] All patients were classified according to Wagner's grade and management protocol was modified as per grade of involvement.[6]

Foot lesions are amongst the commonest indication for hospitalisation amongst diabetic patients.[7] 60-80% of the non-traumatic amputations are performed in diabetics and there is 15-fold risk of major amputations. 45-85% of lower extremity amputations are preventable if aggressive, prompt and correct line of treatment is followed.[8] Management includes control of diabetes, treatment of infections as per culture report from deep tissue curetting and assessment of vascular status. The Doppler spectral analysis revealed spectral broadening, increase in peak systolic velocity and a monophasic wave pattern. Arterial blocks are localized with recording of segmental pressure and pulse volume traces. Diabetic neuropathy usually develops after many years of hyperglycaemia.[9]

The incidence of lower extremity amputation in a diabetic patient can be predicted by assessing various risk factors.[10] Risk factors significant in this study were rural origin, duration of diabetes, insulin therapy, poor compliance, irregular foot wear habit/walking barefoot, absent pedal pulses, retinopathy, proteinuria and abnormal lipid profile. Major amputations were required in patients with overwhelming sepsis or deep compartment abscesses with extensive forefoot gangrene or impending toe loss. Aim of amputation is to preserve the extremity length, as longer the stump the better are the rehabilitation results.[11]

Poor glycemic control is one of the common factors responsible for causing or aggravating foot condition in diabetics. Thus, diabetes patients exhibit 15 times more chances of amputation than non-diabetics.[12,13] Since diabetes is a metabolic disease, lifestyle changes positively impact patient's health. Additionally, pharmacologic management is required with the intervention of antidiabetic agents. These drugs are selected depending on the patient's condition, type/severity of diabetes, age, and other factors. Treatment of type 2 diabetes mellitus is recommended, either when glycemic control is not attained or when hemoglobin A1c increases to >6.5% in 2–3 months after incorporating lifestyle changes.[14]

A good glycemic control is required in diabetes patients to avoid future complications.[12] Qari and Akbar reported in their retrospective study on Arabs that 59% of diabetes patients suffered from foot ulcers. Of these, 65% patients required debridement and 23.5% patients underwent limb amputation. Others had good glycemic control with oral hypoglycemic agents and insulin.[13] Another retrospective cohort study by Schellhase et al demonstrated that a good glycemic control in type 2 diabetes patients decreases the chances of microvascular complications. This further prevents occurrence or aggravation of limb ulcers, gangrene, and amputations.[15]

AIM OF THE STUDY

Purpose of our research was to measure specific co-morbidities like hypertensive and diabetic control in patients before and after amputation in a patient suffering from gangrene.

METHODOLOGY

We carried out a study on 25 individuals in our institutional setting. The patients were aged between 40-65 years of age and were included in the study if they were suffering from co-morbid conditions like hypertension and diabetes and had been advised below knee amputation surgery as they were suffering from gangrene in their limbs. 15 were male patients and rest were female patients. Informed consent was taken for voluntary participation in the study. Clinical data were collected during the admission for foot gangrene treatment. Initial measurements were taken as continuous variables like vitals, HbA 1c level, duration of diabetes and hypertension, Random blood sugar, serum cholesterol, C-reactive protein.

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Angiography was conducted to know the blood flow in the concerned limb to assess the level of amputation area which had no perfusion. Below knee amputation was performed in the patient based on the severity of their general health status. All patients were managed as per grade of involvement by dressing with or without split skin grafting (SSG), wound debridement/drainage followed by wound care with or without SSG, local amputations and lower extremity amputations below or above knee. After carrying out the surgery, their post-surgical vitals as well as noted in their recovery period. Post-surgery, Doppler spectral analysis was carried out to know the status of perfusion.
Statistical analysis was carried out using Student's t test for continuous variables and using frequency measurements like mean as well as standard deviation. The data was recorded on an excel worksheet and analysed through the help of SPSS 25.0 software where statistical significance was kept at less than 0.05.

RESULTS

The average duration of the disease was 8 years and majority of the patients had diabetes for more than 5 years. 5 patients presented with foot lesion as their first symptom. The duration of the foot lesion ranged from 20 to 54 days with a mean of 38 days at time of presentation. (Table 1) The precipitating factors included minor trauma 65%, burns 10%, infection 15% and callosities 10%. Mean value of HbA 1c level was 8.5 pre surgically.
We observed that glycemic control improved with sugar levels returning to near normal which could be medically managed with 68% having RBS level below 200 mg/dl post surgically. (0.61±0.33) In case of patients who were suffering from high blood pressure, their condition also improved drastically after the gangrenous part was removed. Around 38.5% of cases had reduction in their blood pressure level from high to moderate level immediately post-surgery and rest in 2-3 days after surgery. (0.56±0.34) CRP level also was significantly reduced in these patients denoting the decrease in active infection (if at all) in these cases. (0.45±0.2) (Table 2)

Table 1- Demographic characteristics of participants in the study

Variables	Diabetic patients	Hypertensive patients
Gender		
Male	11	6
Female	3	5
Age		
40-50 years	7	2
50-65 years	10	6
Duration of co-morbidity		
<5 years	3	2
>5 years	13	7
Duration of gangrene		
<30 days	1	0
>30 days	17	7

Table 2- Data recorded in the study

Variables	Diabetic patients	P	Hypertensive patients	P value

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	Pre-surgical	**Post-surgical**	**value**	**Pre-surgical**	**Post-surgical**	
	mean±SD	**mean±SD**		**mean±SD**	**mean±SD**	
HbA 1c	3.4±1.23	-	-	2.99±0.78	-	-
RBS	3.99±2.6	0.61±0.33	0.0236	1.4±0.7	1.1±0.3	0.234
BP	1.45±0.96	1.37±0.77	0.132	3.95 ±2.78	0.56±0.34	0.038
CRP	4.32±3.33	0.45±0.2	0.011	3.03±2.66	2.1±1.2	0.039

DISCUSSION

Diabetes is associated with various complications and reduced quality of life (QoL). Of the many complications, some are life-threatening. Among these, foot complications remain an important concern. The major foot complications include foot ulceration, cellulitis, abscess, wet gangrene, dry gangrene, and necrotizing fasciitis, with different pathophysiological concepts behind each of them.[16] As per the World Health Organization, there are always higher chances of limb amputation among diabetic patients as compared to non-diabetics.[17] Amputation may lead to longer hospital stay, increased deaths, and reduced rehabilitation.

As per a retrospective study conducted by Badri et al on 222 patients with a total of 252 amputations, the percentage of patients who were hospitalized for >10 days post-amputation ranged between 50% (for those who underwent one toe amputation) and 91% (for those who underwent above-knee amputation). Also, 57.1% of patients with post-surgical complications faced longer hospitalization of more than a month as compared to patients who did not have any post-surgical complications (16.8%). Early deaths were reported in 16 patients (7.2%) who had faced autoamputation. Only 8.8% of patients were rehabilitated after major amputations and had undergone artificial limb fitting.[18]

Apart from medical treatment, educating people about diabetes, diabetes control, and foot care should be considered important to overcome these challenges.[19] In dry gangrene, due to the presence of clear demarcation, autoamputation concept is widely followed.[20] However, waiting for the affected limb to auto-amputation may increase the discomfort for the patient, in addition to other health challenges. Many reports have shown that surgically amputating the dry gangrene limb relieves patients and improves their QoL with better outcomes. Although several management strategies are available, autoamputation is practiced in certain parts of the globe. [21]

Another retrospective cohort study by Schellhase et al demonstrated that a good glycemic control in type 2 diabetes patients decreases the chances of microvascular complications. This further prevents occurrence or aggravation of limb ulcers, gangrene, and amputations.[22]Moss et al. observed that the risk factors for amputation were: previous history of foot ulcers, advanced age and high blood pressure. Among 1,370 diabetics with disease inception after the age of 30, the risk factors for amputation were: male gender, history of foot ulcers, elevated levels of glycosidic hemoglobin, proteinuria, and length of time since diabetes mellitus diagnosis. On the other hand, Reiber et al. did not find a significant correlation with the length of time since diabetes mellitus diagnosis.[23]

We observed that within 2-3 days post-surgery, CRP levels came to near normal. There was a significant immediate post-operative drop in the sugar levels which was gradually managed and maintained at a healthy level with the help of medical management and there was a reduction blood pressure level as well which gradually stabilized in case of uncontrolled hypertensive patients.

CONCLUSION

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Patients with an infected diabetic foot and advanced age, long duration of diabetes mellitus, uncontrolled hypertension and affected by chronic arterial insufficiency without the possibility of revascularization, present a high risk of needing major amputation. However, with effective medical management and surgical removal of gangrenous part, the vitals as well as glycemic control had improved for the better.

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